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MONTANA AIR QUALITY DATA & INFORMATION SUMMARY FOR 1988 & 1989

Air Quality Bureau
Environmental Sciences Division
Department of Health
and Environmental Sciences
Helena, Montana 59620

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Compiled by
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Department of Health and Environmental Sciences
Helena, Montana 59620

May 1991

Acknowledgement

As with many projects, the compilation of this report was due to the efforts of many people. I'd like to express my thanks to the staff of the Air Quality Bureau, Site Operators, County and Local agency staff whose contributions in collecting, analyzing and processing air quality data continue to produce high quality results.

In addition, I'd like to thank the staff who assisted in compiling the report and appendices, and Carolyn Pelletier for her patience and cooperation in reformatting the entire report.

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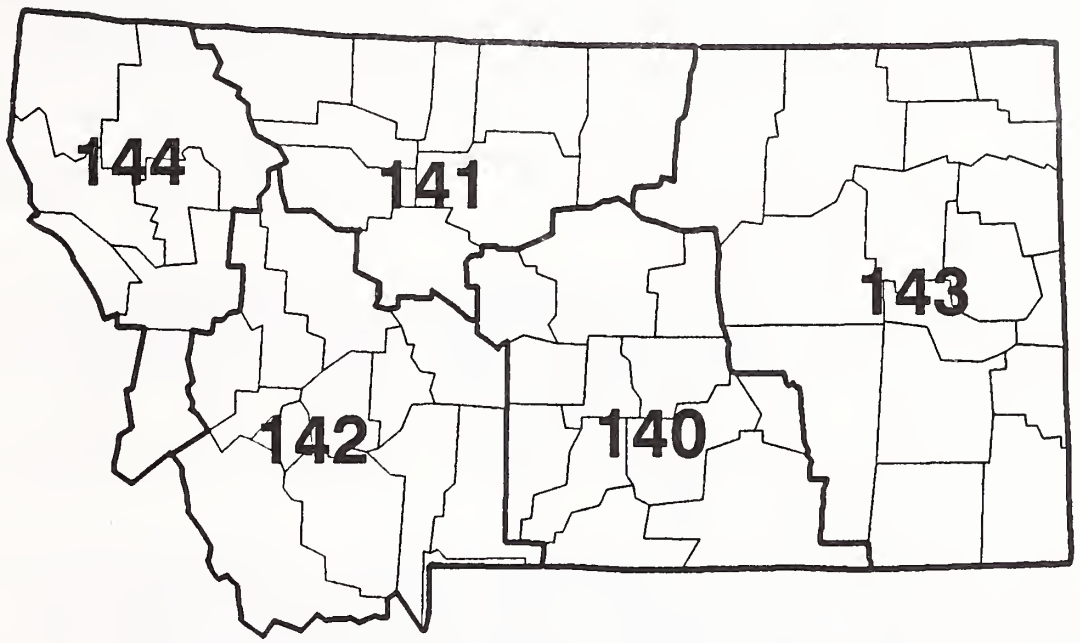
Montana Air Quality Control Regions



Introduction

The purpose of the Montana Air Quality Data and Information Summary is to summarize air quality data collected within the state and to provide information on air quality topics.

With the adoption of the Clean Air Act, EPA divided the state into five geographical regions. Each of these Air Quality Control Regions (AQCRs) contains distinct meteorological patterns, topography and industrial influences. This report addresses the monitoring activities by AQCR. Within each region, various background information is provided. This includes: location of the AQCR, physical features, population, types of pollution sources, monitoring site descriptions, summaries of the air quality data, and the number of data values exceeding the federal and Montana ambient standards.

The air quality data summaries have been tabulated to show the following: site

code, site name, year of record, month, number of observations, first, second and third maxima, arithmetic mean, three-hour maximum (SO_2), eight-hour maximum (CO), 24-hour maximum (SO_2), geometric mean (TSP), and weighted annual average (PM-10).

The data contained in this report is mainly criteria pollutants which we are required to collect by EPA and our State Network Review. The data is collected not only by Air Quality Bureau staff but by several local government agencies and a network of hi-vol operators located throughout the state. County agencies often collect additional data for use with their local air pollution programs (Wood Stove Curtailment, Alert programs, etc.). Industries provide background and source oriented data as a requirement of their operating permits. Most of this additional data is available, upon request, at the Air Quality Bureau.

The data collected by the Air Quality Bureau undergoes various quality assurance (QA) procedures to validate the readings. Each level within the chain of custody is audited for compliance with EPA's prescribed guidelines. This includes operating procedures, equipment performance, laboratory methods, data validity and data processing. It is due partly to these QA procedures that there is a time lag involved in obtaining reports of air quality data.

During 1988 and 1989, the monitoring network was modified to focus on changing priorities. Due to the implementation of the federal PM-10 Standards in 1987, the bureau discontinued most of the TSP network to concentrate on the more labor-intensive PM-10 monitoring. Monitoring was discontinued in areas doing background monitoring, such as Eastern Montana, and manpower was shifted to serve the problem areas of western Montana.

Several communities in Western Montana were designated as Group I and II PM-10 areas--having a high probability of exceeding the standards. Depending upon their classification, extensive monitoring and source contribution studies would have to be accomplished, and implementation plans devised to bring these areas into compliance with air quality standards. Several communities are involved in this process at present.

During the summer of 1988, Montana was plagued by a series of large forest fires. There were times during the summer and early fall when almost the entire state was impacted by the smoke from these fires. The resultant high values were flagged as exceptional events in the air monitoring database. These flagged values will be excluded when determining violations of the PM-10 standards.

AQCR 140

In south central Montana the major air pollution problem continues to involve SO_2 in the Billings area. Contributing sources include a coal-fired power plant and three oil refineries. There were no violations of the federal standards in 1988 or 1989.

During the legislative session of 1987, the Montana SO_2 standards were rescinded for the Billings/Laurel area in response to lobbying efforts of various local groups. This

area has seen violations of the more stringent Montana standards but has managed to stay within the federal limits.

A committee of Billings industry representatives, Chamber of Commerce, and air pollution professionals continues to monitor and report on the air quality of the area. The aim of the committee is also to arrive at some solution to the air pollution problems of Billings and Laurel. The Billings/Laurel Air Quality Technical Committee (BLAQTC) meets once a month in Billings.

AQCR 141

In north central Montana the pollutant of concern is carbon monoxide in Great Falls. There was one violation of the Montana and federal 8-hour standards for CO in 1988, and no violations in 1989. These violations are often due to a combination of automobile emissions and stagnant weather conditions.

AQCR 142

In southwest Montana the major air pollution problems involve particulate matter and lead. High concentrations of lead at three sites in the East Helena area resulted in violations of the federal calendar quarter standard for all quarters during 1988 and ten of twelve quarters in 1989. Lead concentrations remain high despite numerous control measures instituted at the primary lead smelter over the past several years. Due to the difficulty of meeting the lead standards, the state and local government agencies, and industries in the smelter area are operating under a strict implementation plan to bring the area into compliance with air pollution standards.

PM-10 was monitored in Bozeman, East Helena, Helena, and Butte. The highest reading in this region occurred at the Butte Greeley School site which had several violations of the 24-hour standard. This area is also under a State Implementation Plan (SIP) to bring the area into compliance.

AQCR 143

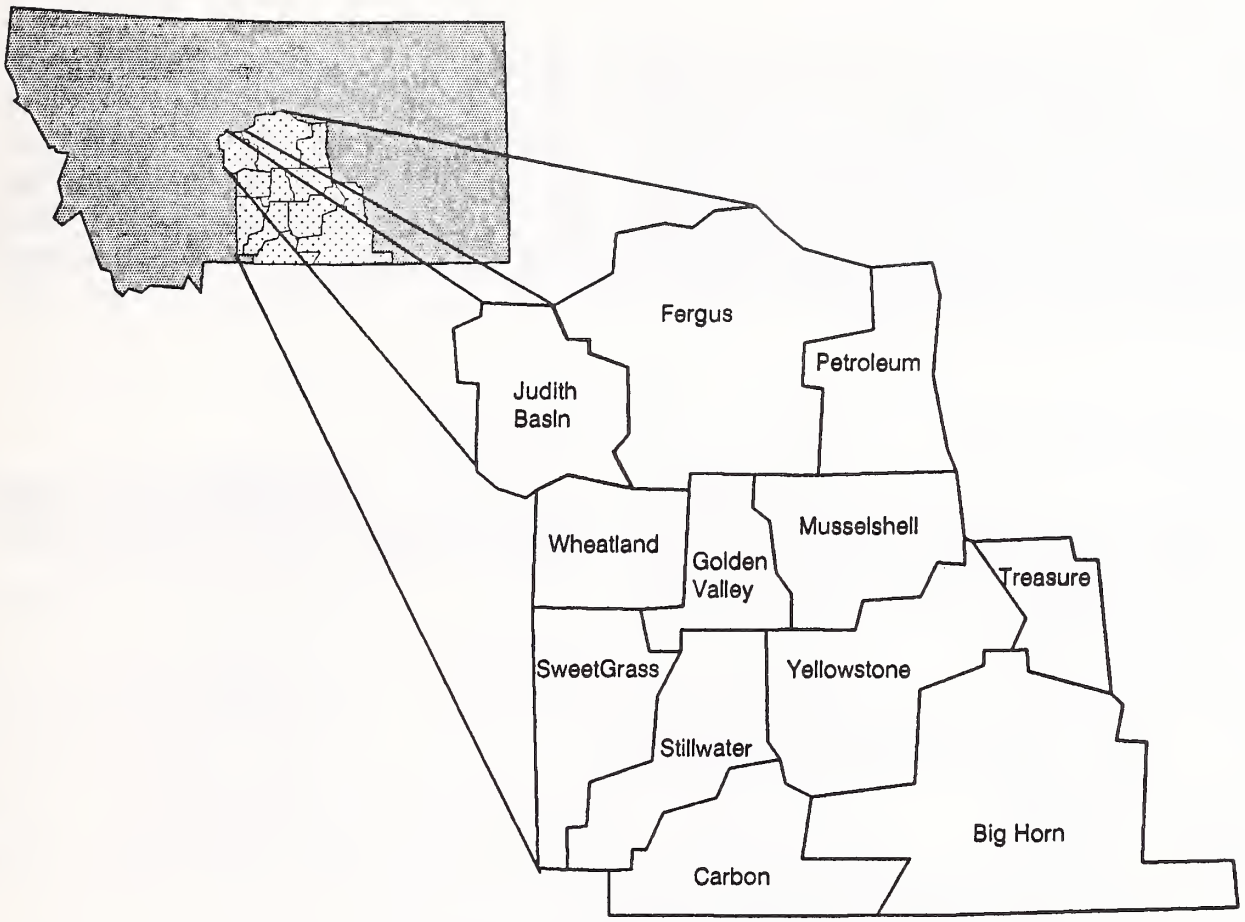
In eastern Montana monitoring was drastically curtailed. Due to the geography of the area and sparse population, this AQCR enjoys relatively unpolluted air. There were no violations of any air pollution standards in this region during 1988 and 1989. Sulfation plate monitoring was performed downwind of a coal-fired power plant during 1988 and 1989 and continue to show very low levels. This method is used as an alternative to more expensive continuous SO^2 analyzers. Other sources of air pollution include oil well flares and vents.

AQCR 144

In western Montana the major air pollution problem continues to be particulate matter. Several sites are violating the PM-10 standards and are designated as areas which must complete extensive monitoring and develop control plans. A violation of the PM-10 standard is based upon an expected three-year average, data recovery criteria, and various statistical methods. The mountainous areas of western Montana with their frequent temperature inversions have the greatest difficulty in controlling PM-10. The city of Missoula also struggles with periodic exceedances of the carbon monoxide standards. There were two violations of the eight-hour CO standard of 9 ppm at the Malfunction Junction site in Missoula during 1988 and two violations at the same site in 1989.

Several appendices are provided in this report on a variety of topics relating to air quality. These include Attainment-Nonattainment Designations, Ambient Air Quality Standards, and Point Source Emissions.

This report was compiled for use by the general public to provide a brief overview of the air quality of Montana. The Air Quality Bureau has a small technical library of air quality publications, various statistical reports and data summaries, all available to the general public. The staff of the AQB also welcomes the opportunity to answer questions and provide insights into the air quality of Montana.



AQCR 140
South Central Montana

LOCATION AND PHYSICAL FEATURES

AQCR 140 includes twelve counties located in south central Montana. The south western border of this area lies on the eastern edge of the Rocky Mountains. As we travel to the north and east, geographical features include mountainous areas, foothills and sedimentary plains. The Yellowstone and Musselshell Rivers flow from west to east and cut through the center of the region. The Missouri River borders the region on the north; Wyoming borders it on the south.

The climate of the area is characterized as semi-arid; cold dry winters, cool moist spring and warm summers.

POPULATION

The 1988 estimated population of AQCR 140 was 168,800 or approximately 21 percent of the state population. The majority of people in this region, 69% of the AQCR population, live in Yellowstone County. The Billings/Laurel area is the largest urban area and industrial center of Montana. Outside this area, agriculture is the predominant economic activity including dryland farming and rangeland, and irrigated crops. Many counties whose primary activities are agricultural-based have declined in population since the 1980 census.

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Big Horn County

- Four coal strip mines (particulates)

Carbon County

- Calcium manufacturing (particulates)

Stillwater County

- Platinum/palladium mine (particulates)

Yellowstone County

- Three oil refineries (SO_2, H_2S, NOx, SO_3, particulates)
- Coal-fired power plant (SO_2, NOx, particulates)
- Sugar beet refinery (SO_2, NOx, particulates)
- Sulfur plant (SO_2, SO_3)
- Grain processing (particulates)

All Counties

- Asphalt plants (particulates)
- Gravel crushers (particulates)
- Home heating devices (particulates, CO)
- Automobiles (CO, NOx, re-entrained particulates)
- Agricultural activities (particulates)
- Wind erosion (particulates)
- Open burning (particulates)

MONITORING SITE DESCRIPTIONS

The Billings/Laurel area is the population and industrial center for AQCR 140. Consequently, the monitoring effort has been concentrated in this location. Table 1 lists the monitoring site descriptions. This includes site codes, site name, supporting agency, station type, project description, city name and county name, and the parameter or pollutant monitored in 1988 and 1989. During the time period of this report, the state changed from one data handling system (SAROAD) to another EPA database (AIRS). Both identifying codes are used in the tables to describe information relating to the sites.

TABLE 1
AQCR 140 - MONITORING SITE DESCRIPTIONS

SAROAD/AIRS AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0080 003 G 02 111 0003	113 BITTERROOT DRIVE YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-NEAR URBAN SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 004 G 02 111 0004	114 JOHNSON LANE YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 006 G 02 111 0006	LOCKWOOD SCHOOL YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 007 G 01 111 0007	KGHL STATION, WEST OF BILLINGS ON HWY 10 YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL POPULATION ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 008 G 01 111 0008	CITY HALL, 3RD AVE NORTH & 27TH STREET YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-COMMERCIAL POPULATION ORIENTED	BILLINGS YELLOWSTONE	TSP,SULFATION RATE
0080 008 G 07 111 0008	3RD AVE N. & 27TH STREET YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-COMMERCIAL QA-COLLOCATED SAMPLER	BILLINGS YELLOWSTONE	TSP
0080 017 G 02 111 0017	MINNESOTA AVENUE, 1/2 MI NE OF CONOCO YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 018 G 02 111 0018	5TH STREET & SOUTH 28TH YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 019 G 02 111 0019	SOUTH 27TH & 11TH AVENUE SOUTH YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-COMMERCIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 034 G 02 111 0034	PICCOLO & FRONTAGE ROAD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-INDUSTRIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 038 G 02 111 0038	JOHNSON ROAD NORTH, 1 MILE NE OF EXXON YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 061 G 02 111 0061	METRA PARKING LOT,6TH AVE & EXHIBITION DR YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-COMMERCIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 065 G 02 111 0065	LOCKWOOD PARK YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE
0080 066 F 05 111 0066	COBURN ROAD, SOUTH OF BILLINGS MONTANA AIR QUALITY BUREAU	RURAL-NEAR URBAN SPECIAL STUDIES	BILLINGS YELLOWSTONE	SO2,WIND
0080 066 G 02 111 0066	COBURN ROAD YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-NEAR URBAN SOURCE ORIENTED	BILLINGS YELLOWSTONE	SULFATION RATE

TABLE 1a
AQCR 140 - MONITORING SITE DESCRIPTIONS

SAROAD/AIRS AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0080 073 F 02 111 0073	SCOTTISH RITES, CORNER 14TH & TERRY MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SO2,WIND,O3
0080 073 G 02 111 0073	SCOTTISH RITES-COUNTY, CORNER 14 & TERRY MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	TSP,SULFATION RATE
0080 075 G 02 111 0075	METRA/EXPOSITION DRIVE & 4TH AVE NORTH MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	CO,WIND
0080 076 F 02 111 0076	PONDEROSA SCHOOL, 4188 KING AVE EAST MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	SO2,WIND
0080 077 G 02 111 0077	FEDERAL CREDIT UNION,2522-4TH AVE NO MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL SOURCE ORIENTED	BILLINGS YELLOWSTONE	PM10
0840 001 G 02 111 1001	LAUREL JUNIOR HIGH - 410 COLORADO AVE YELLOWSTONE COUNTY AIR POLLUTION CONTROL	CITY CENTER-RESIDENTIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	TSP,SULFATION RATE
0840 003 G 02 111 1003	ROADHOUSE ROAD - 1 MI NE OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-INDUSTRIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 005 G 02 111 1005	LAUREL WATER PLANT - 1/2 MI S OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-NEAR URBAN SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 006 G 02 111 1006	WEST LAUREL CHURCH - 1/2 MI WNW OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 009 G 02 111 1009	FARM EAST OF CENEX - 3/8 MI NE OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-AGRICULTURAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE
0840 013 G 02 111 1013	WEST COOP - 1/4 MI WEST OF CENEX YELLOWSTONE COUNTY AIR POLLUTION CONTROL	RURAL-INDUSTRIAL SOURCE ORIENTED	LAUREL YELLOWSTONE	SULFATION RATE

PARAMETER ABBREVIATIONS:

TSP - TOTAL SUSPENDED PARTICULATES
PM-10 - PARTICULATE MATTER 10 (10 MICRONS AND UNDER)
CO - CARBON MONOXIDE
SO_2 - SULFUR DIOXIDE
WIND - WIND SPEED, WIND DIRECTION AND TEMPERATURE

DATA SUMMARY

Total Suspended Particulates

TSP was monitored at three sites in this region during 1988 and 1989. One site, City Hall in Billings, ran a collocated sampler. In 1988 the maximum 24-hour observation of 182 $\mu g/m^3$ occurred during September at the Scottish Rites site in Billings. All three area sites recorded elevated readings on September 6, 1988 due to forest fires burning in Yellowstone Park and other areas of Montana. The highest annual geometric average for 1988 was 61 $\mu g/m^3$ at the City Hall site.

In 1989, the maximum 24-hour observation of 137 $\mu g/m^3$ occurred at the City Hall site in March. The highest annual geometric average for 1989, 53 $\mu g/m^3$, occurred

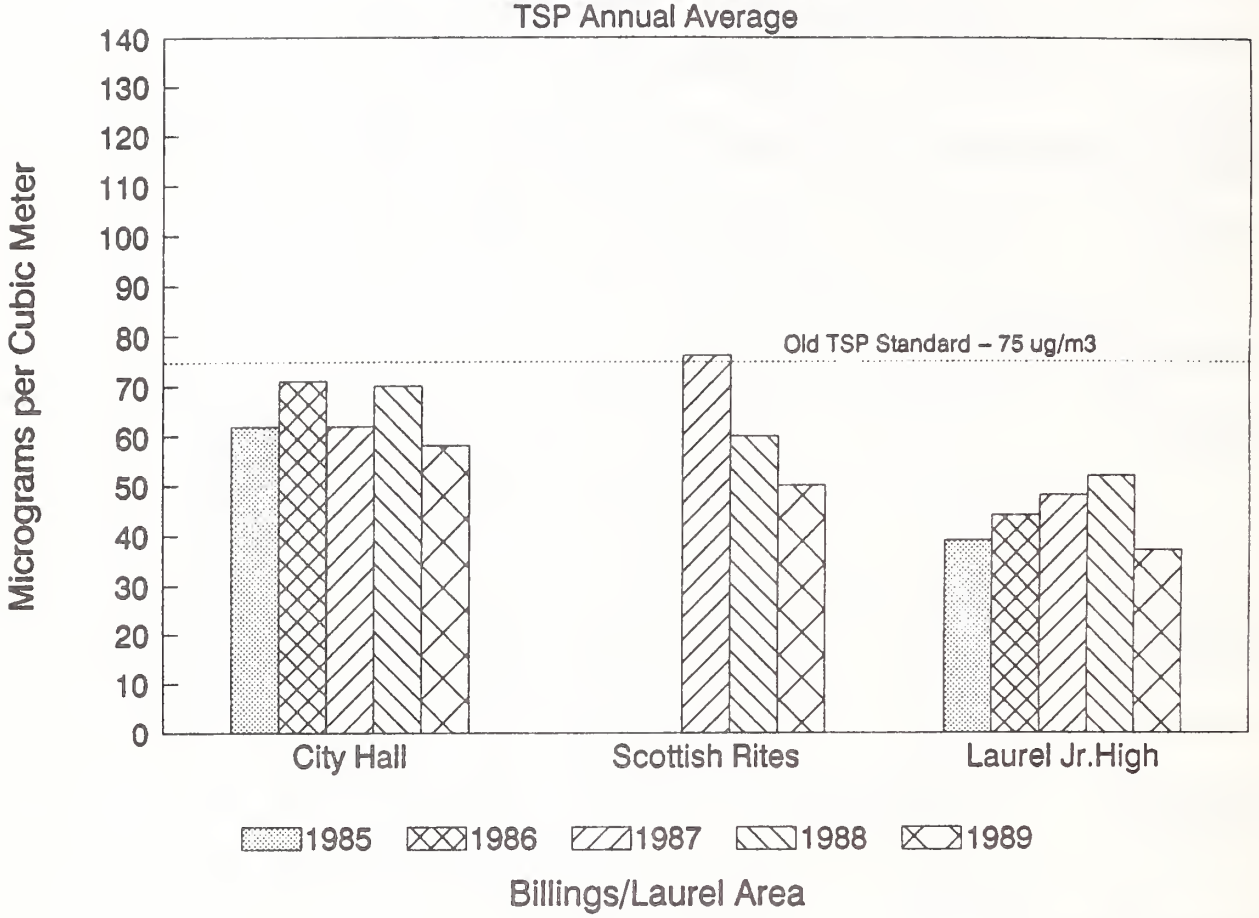
at that same site. Table 2 summarizes the TSP data for this region. Figure 1 shows a five-year comparison of the annual averages for this region's TSP sites.

TABLE 2
AQCR 140 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Codes	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Yellowstone/Billings								
0080 008 G 01	City Hall	85	59	176	135	130	62	56
111 0008 1		86	56	154	123	119	71	63
		87	59	134	109	95	62	58
		88	60	177*	179*	166*	70	61
		89	60	137	133	117	58	53
0080 008 G 07	City Hall-Collocated	85	60	190	143	139	64	59
111 0008 2		86	56	159	121	121	68	61
		87	60	134	109	107	63	58
		88	60	178*	176*	165*	68	59
		89	60	136	130	119	58	52
0080 073 G02	Scottish Rites	87	7	121	84	75	76	73
111 0073 1	(Down 9/89)	88	60	182*	140	130	60	53
		89	42	119	195	90	50	46
Yellowstone/Laurel								
0840 001 G 02	Laurel Junior High	85	53	97	91	72	39	35
111 1001 1		86	57	115	90	80	44	38
		87	61	121	107	95	48	42
		88	57	177*	148	139	52	44
		89	61	103	66	65	37	33

*Data flagged as exceptional events (Forest Fires - August & September 1988)

Figure 1



Carbon Monoxide

Carbon Monoxide was monitored at Exposition Drive and Fourth Avenue near the Billings Metra Complex during 1988 and 1989. In order for Montana to obtain EPA's approval to re-designate Billings as an attainment area for CO, we were required to perform additional monitoring at a location where maximum concentrations were most likely to occur. This new site is approximately 10 meters from a busy intersection near the entrance to the Metra Complex. Sampling began in October of 1988 and the maximum one-hour concentration for that year was 14.2 $\mu g/m^3$. The 1989 maximum one-hour concentration of 12.7 $\mu g/m^3$ occurred in March.

Table 3 summarizes the CO data for this area for 1988 and 1989. The maximum 8-hour concentration was 7.0 $\mu g/m^3$ in 1988 and 7.1 $\mu g/m^3$ in 1989. There were no exceedances of the state or federal CO standards at this site during these two years.

TABLE 3
AQCR 140 - CARBON MONOXIDE
Parts Per Million

County/City Site Codes	Site Name/ Location	Yr	Mo.	Num Obs	Max Obs	2nd Max	3rd Max	8-hr Max	Mo. Avg.
Yellowstone/Billings									
0080 075 G 02	Metra/Exposition	88	01	---	---	---	---	---	---
111 0075 1	Drive and Fourth		02	---	---	---	---	---	---
	Avenue		03	---	---	---	---	---	---
			04	---	---	---	---	---	---
			05	---	---	---	---	---	---
			06	---	---	---	---	---	---
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	581	14.2	12.4	10.3	7.0	2.4
			11	710	11.0	10.6	10.5	5.7	1.6
			12	739	10.4	10.2	9.3	5.1	1.4
	Annual			2030	14.2	12.4	10.5	7.0	---
		89	01	738	10.0	8.4	8.3	5.3	1.4
			02	657	8.8	7.1	6.8	4.4	1.1
			03	728	12.7	10.7	8.9	7.1	1.4
			04	584	4.2	4.2	4.1	3.2	.8
			05	607	3.9	3.8	3.6	2.3	.9
			06	714	4.9	4.8	4.8	3.1	1.4
			07	738	8.7	4.9	4.8	3.1	1.0
			08	534	5.6	4.8	4.4	3.0	1.4
			09	----	----	----	----	----	----
			10	623	9.2	8.6	8.0	5.7	1.3
			11	538	11.6	7.2	6.4	5.0	1.4
			12	142	6.5	6.2	5.0	3.4	.8
	Annual			6603	12.7	10.7	8.9	7.1	----

Sulfur Dioxide

Sulfur dioxide (SO_2) was monitored at three sites during 1988 and 1989. The Scottish Rites site ran for a period of almost two years and continued to show low concentrations of sulfur dioxide. This site was moved to Ponderosa School in October of 1989 in an attempt to monitor another area of the population living in close proximity to the Billings industrial sources.

The highest concentrations continue to appear at the Coburn Road site which is located on a hill above the Yellowstone Valley in a relatively unpopulated area. The

highest one-hour reading for 1988 was .541 $\mu g/m^3$ which occurred in April. Additional high values of .512 and .510 occurred in November and January, which brought to three the number of exceedances of the Montana one-hour standard. In 1989, the one-hour maximum of .506 occurred in December and also exceeded the Montana one-hour standard.

The highest three-hour running average for 1988 (.411 $\mu g/m^3$) and 1989 (.363 $\mu g/m^3$) occurred at the Coburn Road site. Both values were within the federal three-hour block average standard of .50 $\mu g/m^3$.

The highest 24-hour running average of .149 occurred at the Coburn Road site in December of 1988. This concentration exceeded the Montana 24-hour running average standard but stayed within the federal 24-hour block average standard. In 1989 the highest 24-hour average of .101 $\mu g/m^3$, occurred at Coburn Road in March.

Several Billings industries operate additional analyzers as part of a cooperative effort to monitor the concentrations of SO_2 in the Billings area. A five-year summary of the state-operated sites are presented in Table 4; Table 5 shows the number of exceedances.

TABLE 4a
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Codes	Site Name/ Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Mo Avg
Yellowstone/Billings										
0080 066 F 05	Coburn Road	85	01	726	.996	.813	.727	.845	.202	.041
111 0066 1			02	567	.328	.284	.246	.263	.089	.022
			03	517	.358	.253	.247	.212	.120	.209
			04	245	.240	.208	.128	.119	.032	.009
			05	580	.262	.159	.142	.115	.031	.011
			06	683	.205	.170	.162	.149	.044	.014
			07	728	.334	.219	.204	.169	.053	.023
			08	72	.082	.079	.061	.069	.027	.016
			09	423	.177	.152	.138	.110	.034	.011
			10	704	.502	.443	.359	.408	.135	.031
			11	635	.305	.295	.288	.246	.111	.031
			12	547	.305	.290	.261	.204	.099	.033
	ANNUAL			6427	.996	.813	.727	.845	.202	.024

TABLE 4b
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Codes	Site Name/ Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Mo Avg
Yellowstone/Billings										
0080 066 F 05 111 0066 1	Coburn Road	86	01	739	.254	.206	.206	.222	.094	.030
			02	651	.603	.529	.270	.467	.109	.024
			03	723	.389	.148	.130	.183	.042	.014
			04	714	.314	.289	.185	.250	.055	.015
			05	730	.149	.139	.136	.096	.042	.011
			06	515	.332	.187	.171	.178	.060	.018
			07	339	.233	.180	.146	.143	.042	.019
			08	736	.489	.366	.329	.311	.092	.041
			09	551	.268	.154	.134	.138	.034	.014
			10	676	.411	.386	.338	.285	.108	.042
			11	715	.337	.320	.272	.224	.102	.033
			12	721	.394	.323	.317	.251	.097	.045
ANNUAL				7810	.603	.529	.489	.467	.109	.026
0080 066 F 05 111 0066 1	Coburn Road	87	01	734	.280	.218	.194	.145	.066	.025
			02	630	.217	.200	.183	.149	.056	.024
			03	702	.205	.201	.183	.156	.047	.016
			04	671	.239	.239	.220	.200	.061	.017
			05	570	.155	.149	.145	.120	.031	.012
			06	686	.219	.219	.208	.167	.046	.017
			07	706	.350	.230	.221	.167	.047	.019
			08	223	.237	.207	.202	.168	.048	.021
			09	333	.364	.359	.355	.357	.087	.039
			10	671	.338	.333	.333	.285	.120	.035
			11	685	.335	.319	.277	.231	.086	.036
			12	642	.689	.351	.303	.357	.132	.028
	ANNUAL			7258	.689	.364	.359	.357	.132	.024
0080 066 F 05 111 0066 1	Coburn Road	88	01	475	.510	.264	.253	.347	.119	.031
			02	611	.309	.242	.233	.192	.066	.021
			03	695	.199	.192	.159	.112	.031	.012
			04	646	.541	.282	.243	.411	.066	.016
			05	694	.279	.158	.145	.162	.046	.014
			06	659	.355	.207	.203	.242	.066	.015
			07	705	.236	.168	.152	.110	.048	.023
			08	699	.249	.242	.231	.162	.061	.021
			09	528	.240	.166	.165	.121	.054	.022
			10	467	.355	.327	.271	.232	.068	.027
			11	579	.512	.303	.213	.319	.076	.024
			12	633	.430	.355	.352	.324	.149	.034
	ANNUAL			7391	.541	.355	.352	.411	.149	.021

TABLE 4c
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Codes	Site Name/ Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Mo Avg
Yellowstone/Billings										
0080 066 F05	Coburn Road	89	01	701	.179	.165	.162	.165	.081	.035
111 0066 1			02	589	.214	.200	.186	.148	.070	.025
			03	704	.479	.375	.284	.363	.101	.031
			04	618	.245	.220	.199	.195	.056	.015
			05	605	.134	.127	.110	.080	.028	.014
			06	685	.263	.221	.220	.202	.043	.013
			07	699	.260	.197	.168	.167	.039	.017
			08	708	.159	.154	.150	.111	.041	.018
			09	678	.385	.353	.296	.273	.081	.033
			10	548	.151	.146	.146	.124	.053	.024
			11	664	.189	.146	.127	.101	.038	.015
			12	697	.506	.238	.194	.283	.094	.025
	ANNUAL			7896	.506	.375	.296	.363	.101	.022
0080 073 F 02	Scottish Rites	88	01	---	---	---	---	---	---	---
111 0073 1			02	576	.102	.059	.042	.068	.020	.004
			03	704	.057	.047	.046	.040	.013	.002
			04	682	.082	.053	.051	.045	.012	.004
			05	702	.102	.067	.055	.071	.014	.004
			06	680	.076	.055	.050	.044	.013	.003
			07	705	.058	.054	.046	.044	.012	.004
			08	698	.100	.057	.050	.068	.021	.004
			09	668	.056	.054	.041	.038	.012	.004
			10	702	.097	.087	.058	.064	.013	.007
			11	681	.085	.079	.065	.065	.026	.006
			12	636	.178	.139	.125	.105	.064	.009
	ANNUAL			7411	.178	.139	.125	.105	.064	.005
0080 073 F 02	Scottish Rites	89	01	703	.067	.063	.050	.039	.022	.008
111 0073 1	(Down 9/89)		02	635	.110	.108	.105	.086	.051	.014
			03	698	.117	.108	.082	.092	.045	.009
			04	708	.033	.029	.028	.024	.008	.002
			05	678	.071	.045	.039	.048	.010	.002
			06	45	.018	.017	.009	.011	.005	.003
			07	638	.057	.046	.032	.037	.009	.002
			08	691	.066	.057	.056	.053	.016	.004
			09	243	.038	.038	.035	.022	.005	.002
			10	---	---	---	---	---	---	---
			11	---	---	---	---	---	---	---
			12	---	---	---	---	---	---	---
	ANNUAL			5039	.117	.108	.105	.092	.051	.006

TABLE 4d
AQCR 140 - SULFUR DIOXIDE
Parts Per Million

Site Codes	Site Name/ Location	Yr	Mo	Num Obs	Max Obs	2nd Max	3rd Max	3 Hr Max	24 Hr Max	Mo Avg
Yellowstone/Billings										
0080 076 F 02	Ponderosa	89	01	---	---	---	---	---	---	---
111 076 1	School		02	---	---	---	---	---	---	---
			03	---	---	---	---	---	---	---
			04	---	---	---	---	---	---	---
			05	---	---	---	---	---	---	---
			06	---	---	---	---	---	---	---
			07	---	---	---	---	---	---	---
			08	---	---	---	---	---	---	---
			09	---	---	---	---	---	---	---
			10	587	.115	.078	.069	.026	.026	.005
			11	682	.047	.036	.035	.013	.013	.004
			12	501	.098	.092	.080	.024	.043	.008
	ANNUAL			1770	.115	.092	.080	.026	.043	.006

TABLE 5
AQCR 140 - SO_2 - NUMBER OF EXCEEDANCES
Parts Per Million

				Federal Prim		Federal Sec	Billings/Laurel Standards		
County/City Site Codes	Site Name/ Location	Yr	Num Obs	24-Hr 0.14	Annual 0.03	3-Hr 0.50	1-Hr 0.50	24-Hr 0.14	Annual 0.03
Yellowstone/Billings									
0080 066 F 05	Coburn Road	85	6427	1	0	2	--	--	--
111 0066 1		86	7810	0	0	0	--	--	--
		87	7258	0	0	0	0	0	0
		88	7391	0	0	0	3	1	0
		89	7896	0	0	0	1	0	0
0080 073 F 02	Scottish Rites	88	7411	0	0	0	0	0	0
111 0073 1	(Down 9/89)	89	5039	0	0	0	0	0	0
0080 076 F 02	Ponderosa School (Began 10/89)	89	1770	0	0	0	0	0	0

Sulfation Rate

Nineteen sites in Yellowstone County monitored sulfation rate in 1988 and 1989. The highest monthly concentration of 1.5 μg SO_3/100 cm^2/day occurred at two sites during 1988; Johnson Road North in Billings and Farm East of Cenex at Laurel. The highest annual average of .89 μg SO_3/100 cm^2/day occurred at Johnson Road North. There is no standard for sulfation rate; however, readings greater than 0.5 mg SO_3/100 cm^2/day indicate possible trouble spots and warrant continued sampling. Table 6 summarizes the sulfation rate data. Figures 2 and 3 display a five-year comparison of the sulfation rate data at the Billings and Laurel sites.

TABLE 6a
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters Per Day

County/City Site Codes	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Billings							
0080 003 G 02	Bitterroot	85	12	.51	.51	.47	.32
111 0003 1		86	12	.69	.55	.52	.41
		87	12	.39	.33	.32	.24
		88	12	.4	.4	.3	.23
		89	11	.4	.4	.3	.28
0080 004 G 02	Johnson Lane	85	12	1.13	1.00	.92	.64
111 0004 1		86	10	1.23	.92	.85	.81
		87	12	.70	.66	.65	.49
		88	12	.8	.8	.7	.49
		89	11	.8	.7	.6	.50
0080 006 G 02	Lockwood School	85	12	.98	.87	.86	.64
111 0006 1		86	12	1.03	.96	.96	.81
		87	12	.72	.68	.67	.56
		88	12	.9	.7	.6	.49
		89	9	.8	.8	.8	.64
0080 007 G 01	KGHL Station	85	12	.69	.58	.44	.30
111 0007 1		86	12	.61	.44	.44	.32
		87	12	.44	.40	.38	.29
		88	12	.5	.5	.4	.31
		89	11	.7	.6	.5	.39
0080 008 G 01	City Hall	85	12	.61	.55	.49	.30
111 0008 1		86	12	.45	.42	.36	.30
		87	12	.31	.28	.26	.20
		88	12	.4	.4	.3	.21
		89	11	.5	.4	.4	.24

TABLE 6b
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters Per Day

County/City Site Codes	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Billings							
0080 0017 G 02	Minnesota Avenue	85	12	.78	.73	.66	.45
111 0017 1		86	12	.80	.73	.67	.52
		87	12	.48	.43	.40	.31
		88	12	.6	.6	.6	.33
		89	11	.8	.7	.5	.38
0080 018 G 02	5th Street & South	85	12	.66	.56	.39	.31
111 0018 1	28th	86	12	.59	.53	.47	.36
		87	12	.35	.33	.31	.23
		88	12	.4	.4	.3	.23
		89	11	.5	.4	.4	.28
0080 019 G 02	South 27th & 11th Ave	85	12	.92	.85	.82	.54
111 0019 1	South	86	12	.83	.76	.72	.54
		87	12	.71	.70	.43	.40
		88	12	.7	.6	.5	.36
		89	11	.9	.6	.6	.49
0080 034 G 02	Piccolo & Frontage	85	12	1.38	1.29	1.19	.99
111 0034 1	Road	86	12	1.68	1.51	1.38	1.22
		87	11	1.22	1.10	1.07	.87
		88	12	1.2	.9	.9	.70
		89	11	1.2	1.1	1.1	.94
0080 038 G 02	Johnson Road North	85	12	1.80	1.68	1.51	.95
111 0038 1		86	11	2.02	1.95	1.85	1.28
		87	12	1.52	1.42	1.35	.96
		88	12	1.5	1.5	1.2	.89
		89	11	1.4	1.2	1.2	.84
0080 065 G 02	Lockwood Park	85	12	.87	.84	.81	.66
111 0065 1		86	11	1.17	1.11	1.06	.92
		87	12	.73	.70	.65	.53
		88	12	.9	.8	.8	.60
		89	11	.8	.7	.7	.56
0080 066 G 02	Coburn Road	85	12	1.89	1.70	1.61	1.06
111 0066 1		86	12	1.87	1.57	1.49	1.17
		87	12	1.14	1.13	.75	.66
		88	12	1.2	1.1	.9	.59
		89	11	1.3	.9	.8	.66

TABLE 6c
AQCR 140 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters Per Day

County/City Site Codes	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Yellowstone/Billings							
0080 073 G 02	Scottish Rites	87	1	.32	---	---	.32
111 0073		88	12	.5	.4	.4	.23
		89	7	.6	.4	.4	.26
Yellowstone/Laurel							
	Laurel Junior High	85	12	.38	.37	.19	.13
0840 001 G 02		86	12	.37	.20	.16	.10
111 1001 1		87	12	.08	.07	.06	.05
		88	12	.1	.1	.1	.07
		89	11	.3	.2	.2	.10
0840 003 G 02	Roadhouse Road	85	12	1.50	1.15	1.02	.64
111 1003 1		86	12	1.59	1.49	1.14	.82
		87	12	1.11	.69	.66	.46
		88	12	1.2	1.0	.8	.52
		89	11	1.1	.9	.8	.54
0840 005 G 02	Laurel Water Plant	85	12	.78	.70	.60	.49
111 1005 1		86	12	1.39	.83	.79	.70
		87	12	.39	.39	.33	.26
		88	12	.5	.4	.4	.28
		89	11	.6	.3	.3	.28
0840 006 G 02	West Laurel Church	85	10	.40	.23	.22	.16
111 1006 1		86	11	.36	.35	.28	.17
		87	11	.13	.10	.08	.06
		88	11	.2	.2	.1	.08
		89	11	.3	.2	.2	.11
0840 009 G 02	Farm East of CENEX	85	12	1.67	1.51	1.28	.96
111 1009 1		86	12	2.11	2.08	1.94	1.43
		87	11	1.36	1.34	1.11	.87
		88	12	1.5	1.2	1.2	.73
		89	11	1.3	1.1	1.0	.73
0840 013 G 02	West Coop	85	12	.39	.38	.37	.23
111 0013 1		86	12	.59	.43	.39	.27
		87	12	.21	.16	.12	.10
		88	12	.3	.2	.2	.13
		89	11	.4	.4	.3	.20

Figure 2

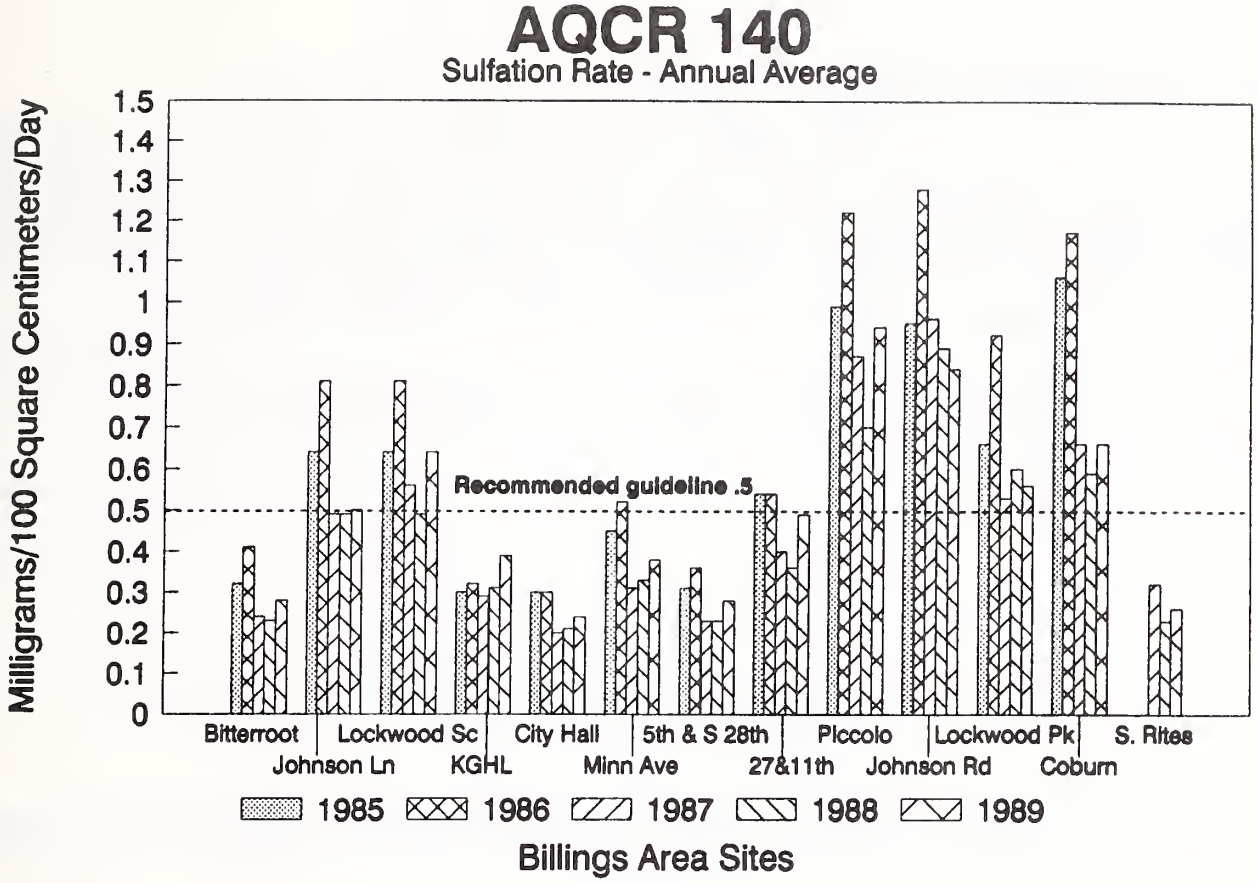
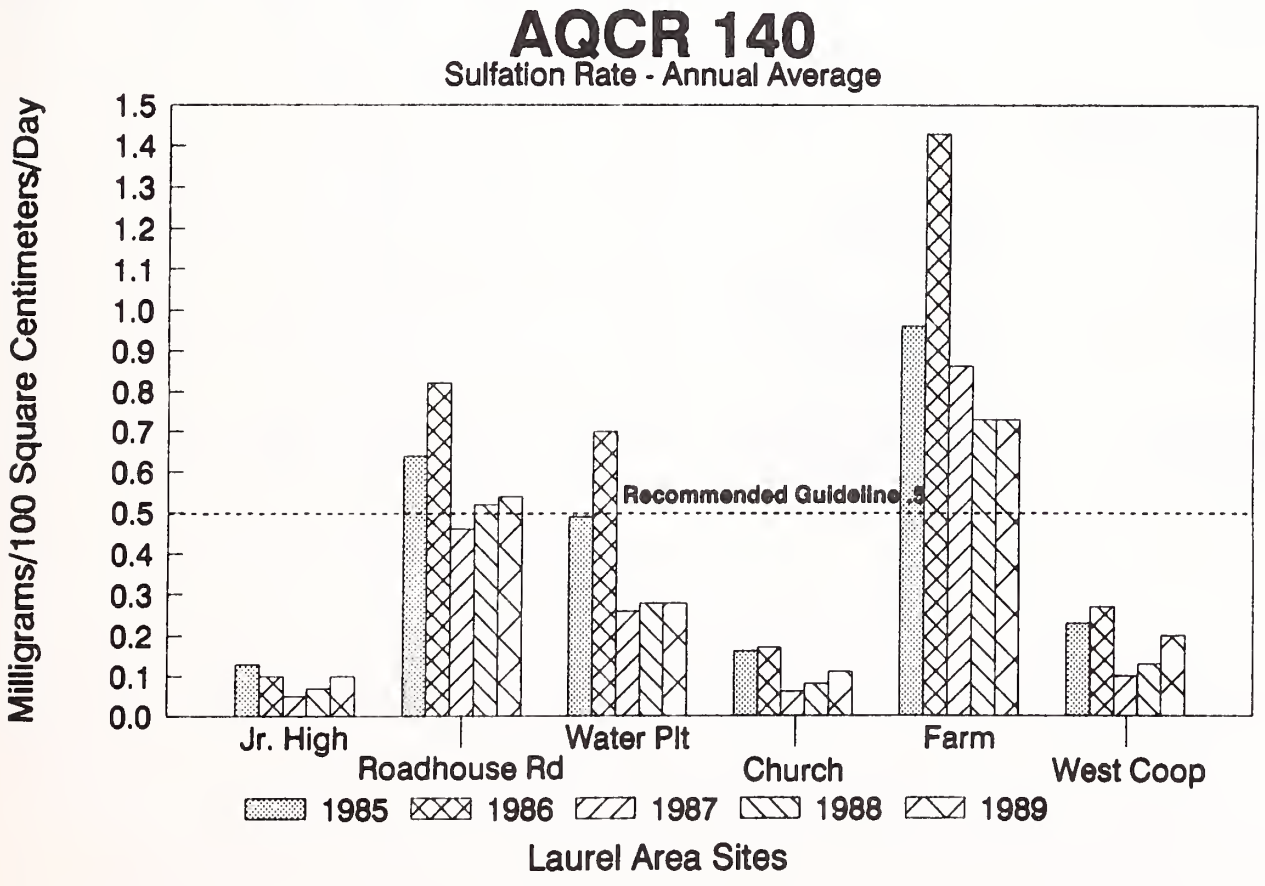


Figure 3



Respirable Particulates (PM-10)

PM-10 was monitored for a short time in 1989 at the Scottish Rites site. The highest 24-hour concentration of 87 $\mu g/m^3$ occurred in March. Monitoring at this site was discontinued in September of 1989 when the adjacent sulfur dioxide site was shut down. Another PM-10 site was established at the Yellowstone Federal Credit Union later that fall to monitor maximum concentrations in downtown Billings.

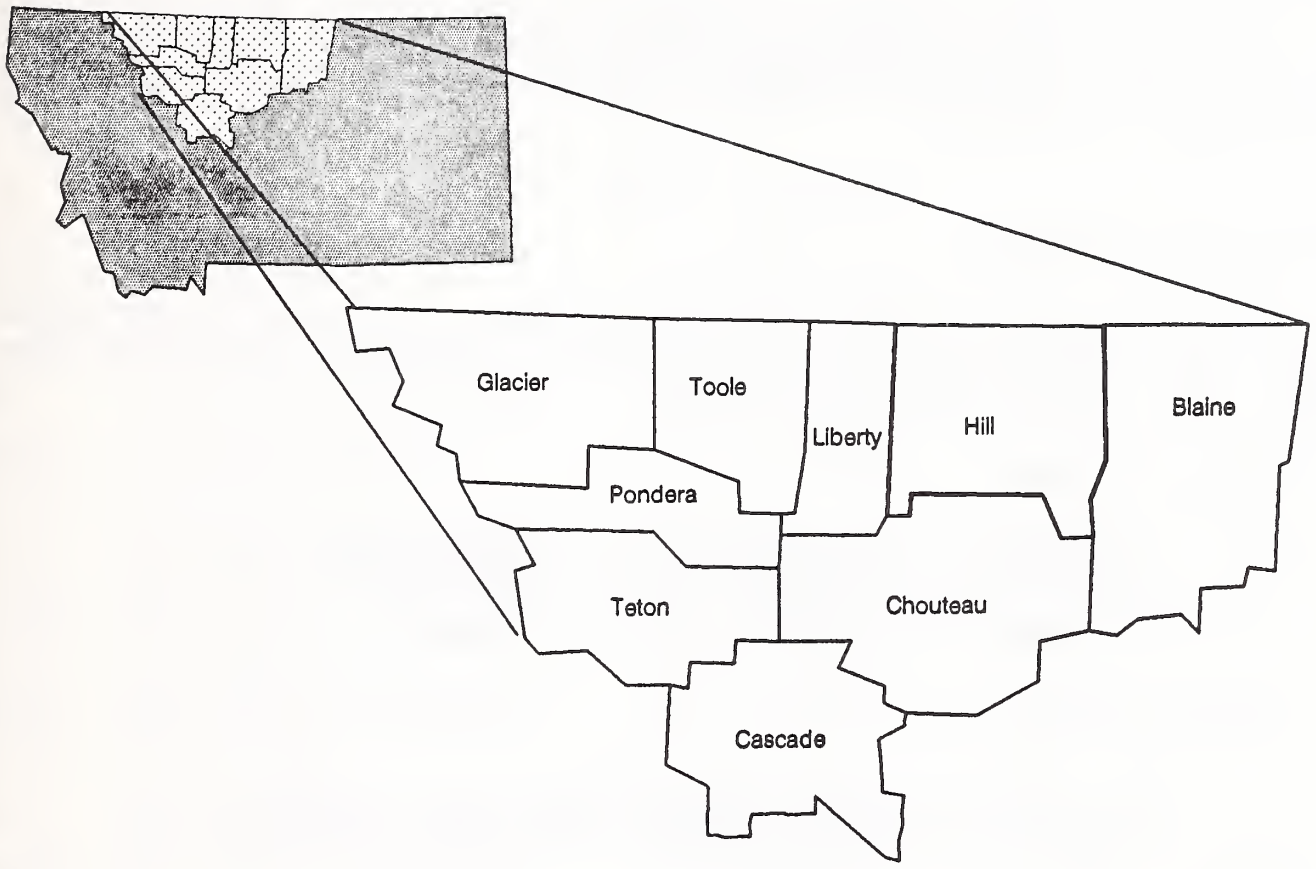
Table 7 summarizes the PM-10 data for the Billings area and Table 8 shows the number of exceedances. Both sites remain well under the PM-10 standards.

TABLE 7
AQCR 140 - RESPIRABLE PARTICULATES (PM-10)
Micrograms per Cubic Meter

County/City Site Codes	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Weighted Arith Mean
Yellowstone/Billings							
0080 073 F 02 111 0073 1	Scottish Rites (Down 9/89)	89	38	87	45	44	23
0080 077 G 02 111 0077 1	Yellowstone Federal Credit Union (Began 11/89)	89	7	47	29	24	22
0080 077 G 07 111 0077 2	Yellowstone Federal Credit Union	89	7	47	26	23	21

TABLE 8
AQCR 140 - PM-10 - NUMBER OF EXCEEDANCES
Micrograms per Cubic Meter

County/City Site Codes	Site Name/Location	Yr	Num Obs	Annual Average >50	Federal/State 24-Hour >150
Yellowstone/Billings					
0080 073 F 02 111 0073	Scottish Rites	89	38	0	0
0080 077 G 02 111 0077 1	Yellowstone Federal Credit Union	89	7	0	0



AQCR 141
North Central Montana

LOCATION AND PHYSICAL FEATURES

AQCR 141 includes nine counties located in north central Montana. The main physical feature of the area is glaciated plains. There are some foothills and mountainous areas along the western edge of the Continental Divide and south of Havre at the Bearpaw Mountains.

The Missouri River flows from west to east in the southern portion of the region. Several other tributary rivers of the Missouri also flow from west to east in the region.

POPULATION

The 1988 estimated population of AQCR 141 was 139,000 or 17.3 percent of the state population. Over half of the people in this region live in Cascade County in or near the city of Great Falls.

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Cascade County

Several grain processing and feed mills (particulates)
Oil refinery (particulates, SO_2, NOx, CO, VOC)
Coal-fired power plant (SO_2, NOx, particulates)

Glacier County

Two gas sweetening plants (SO_2, NOx)
Natural Gas Compressor Stations (particulates, CO, NOx)

Teton County

Gas sweetening plant (SO_2, NOx)

Toole County

Gas sweetening plant (SO_2, NOx)

All Counties

Asphalt plants (particulates)
Gravel crushers (particulates)
Home heating devices (particulates, CO)
Automobiles (CO, NOx, re-entrained particulates)
Agricultural activities (particulates)
Wind erosion (particulates)
Open Burning (particulates)

MONITORING SITE DESCRIPTIONS

Because Great Falls is the population and industrial center of this region, monitoring has been concentrated in this area. Due to a history of problems associated with city traffic and meteorological conditions, monitoring of carbon monoxide has been

mandated in the area . Monitoring site descriptions are listed in Table 9. This includes site codes, site name, supporting agency, station type, project description, city name and county name, and the parameters or pollutants monitored in 1988 and 1989. Site ID codes for both EPA databases (SAROAD and AIRS) are included in all the tables.

TABLE 9
AQCR 141 - MONITORING SITE DESCRIPTIONS

SAROAD/AIRS AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0660 009 G 01 013 0009	FIRE STATION #1 - 9TH ST & 1ST AVE SOUTH CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-RESIDENTIAL POPULATION ORIENTED	GREAT FALLS CASCADE	TSP, PM10
0660 009 G 07 013 0009	FIRESTATION #1-COLLOCATED CASCADE COUNTY HEALTH	CITY CENTER-RESIDENTIAL QA-COLOCATED SAMPLER	GREAT FALLS CASCADE	TSP, PM10
0660 017 G 01 013 0017	DOWNTOWN (WEST) - 301 2ND AVE N CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL POPULATION ORIENTED	GREAT FALLS CASCADE	TSP, PM10
0660 017 G 07 013 0017	DOWNTOWN (EAST) - 301 2ND AVE N CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL QA-COLOCATED SAMPLER	GREAT FALLS CASCADE	TSP
0660 023 G 02 013 0023	PARDIS CLINIC - 826 10TH AVE SOUTH CASCADE COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL SOURCE ORIENTED	GREAT FALLS CASCADE	CO, WIND
0660 024 G 01 013 1024	SUNNYSIDE SCHOOL 1800 19TH AVE SO CASCADE COUNTY AIR POLLUTION CONTROL	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	GREAT FALLS CASCADE	TSP
0660 025 G 02 013 1024	SKYWAY CONOCO, 700-10TH AVE SOUTH MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL SOURCE ORIENTED	GREAT FALLS YELLOWSTONE	CO, WIND

PARAMETER ABBREVIATIONS:

TSP - TOTAL SUSPENDED PARTICULATES
PM-10 - PARTICULATE MATTER 10 (10 MICROMS AND UNDER)
CO - CARBON MONOXIDE
SO_2 - SULFUR DIOXIDE
WIND - WIND SPEED, WIND DIRECTION AND TEMPERATURE

DATA SUMMARY

Total Suspended Particulates

TSP was monitored at three sites in this region during 1988 and 1989. Two of these sites were collocated during 1988. In 1988 the maximum 24-hour observation of 458 $\mu g/m^3$ occurred at the Fire Station #1 site. This high reading was attributed to high winds which swept through the area on February 21, 1988. Additional high readings occurred in September as smoke from forest fires impacted the area. The highest reading during this period not associated with an exceptional event was 157 $\mu g/m^3$ which also occurred at the Fire Station Site in January. The highest annual geometric average for 1988 (65 $\mu g/m^3$) and the highest annual arithmetic average (79 $\mu g/m^3$) occurred at the Fire Station site.

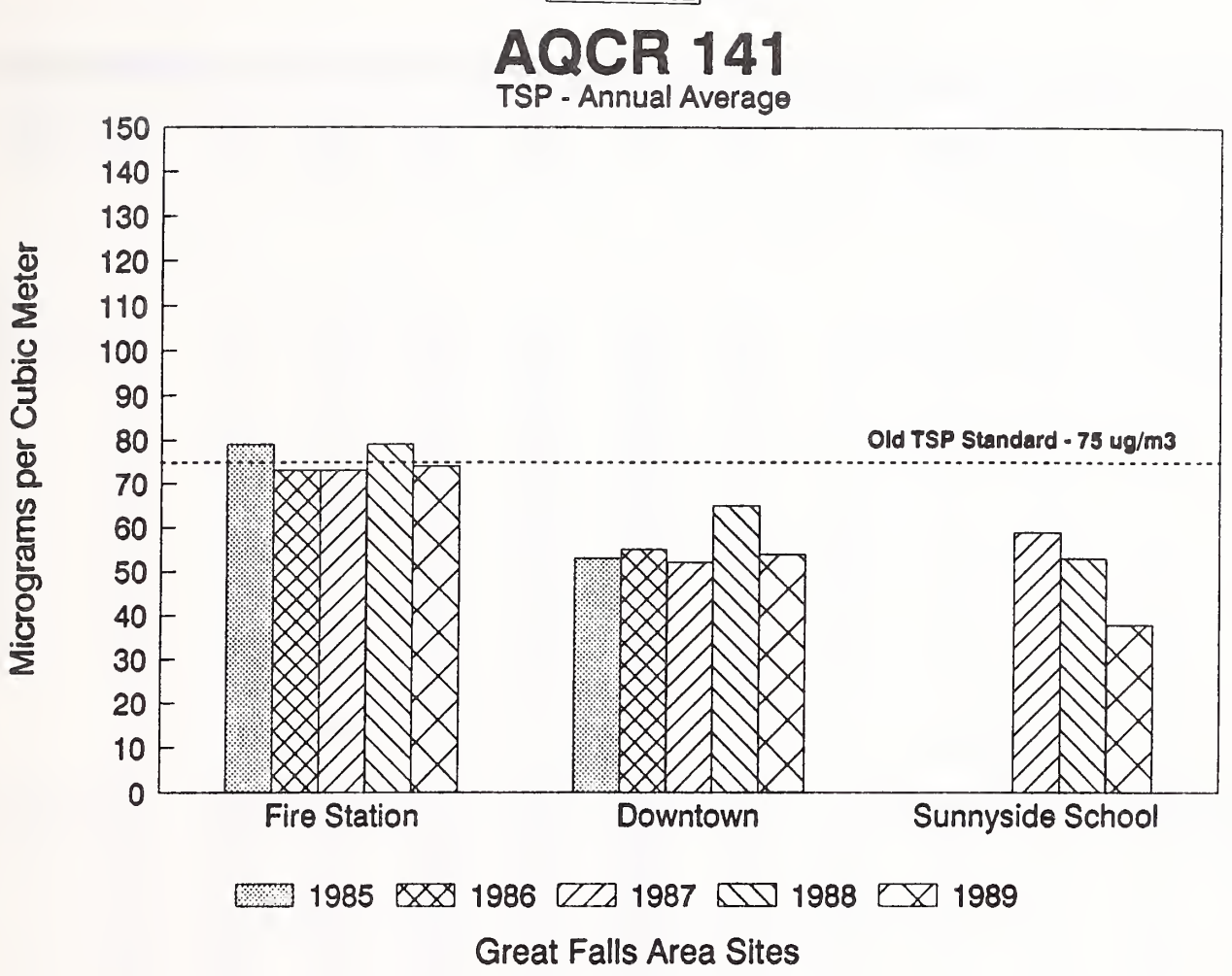
In 1989 the maximum 24-hour observation of 469 $\mu g/m^3$ occurred at Fire Station #1. This high reading occurred in January on a calm day when the streets were clear of snow. The probable cause was re-entrained winter sanding material and road dust. The highest annual geometric average of 59 $\mu g/m^3$ and annual arithmetic average of 74 $\mu g/m^3$ occurred at the Fire Station site. Table 10 summarizes the last five years of TSP data for this region. Figure 4 shows a five-year comparison of the annual averages for the TSP sites in this region.

TABLE 10
AQCR 141 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Cascade/Great Falls								
0660 009 G 01	Fire Station #1	85	55	264	225	208	79	66
013 0009 1		86	58	204	204	201	73	61
		87	61	228	168	124	73	65
		88	60	458*	349*	157	79	65
		89	49	469	192	163	74	59
0660 009 G 02	Fire Station #1 -	88	25	335*	119	101	61	56
013 0009 2	Collocated	89	48	460	173	159	77	64
0660 017 G 01	Downtown	85	59	169	125	121	53	46
013 0017 1		86	58	167	149	135	55	46
		87	61	161	112	104	52	46
		88	57	397*	334*	134	65	50
		89	56	204	132	126	54	45
0660 017 G 07	Downtown - Collocated	85	60	172	122	116	50	43
013 0017 2	(Down 1988)	86	60	171	135	132	54	45
		87	59	179	112	108	53	46
		88	33	367*	142	121	65	50
0660 024 G 01	Sunnyside School	87	50	160	127	116	59	50
013 1024 1		88	47	248*	236*	151	53	45
		89	51	101	86	73	38	33

* Data flagged as exceptional events (High Winds - February 21, 1988)
(Forest Fires - August & September 1988)

Figure 4



Carbon Monoxide

Carbon monoxide was monitored primarily at one location (Pardis Clinic) during this two year period. In October of 1989 it was necessary to move the site to another location (Skyway Conoco). In 1988, the maximum eight-hour observation of 9.5 ppm and the maximum one-hour reading of 19.2 ppm occurred in December. This 8-hour reading accounted for the one exceedance of the CO standard recorded for this area during 1988.

In 1989, the maximum 8-hour observation of 8.6 ppm occurred in January; the maximum one-hour observation of 15.7 occurred in October. There were no violations of the state or federal CO standards in this region during 1989. Table 11 summarizes the last five years of CO data for this region and Table 12 shows the number of exceedances of the CO standards.

TABLE 11a
AQCR 141 - CARBON MONOXIDE
Parts Per Million

County/City Site Code	Site Name/ Location	Yr	Mo.	Num Obs	Max Obs	2nd Max	3rd Max	8-hr Max	Mo. Avg.
Cascade/Great Falls									
0660 023 G 02 013 1023 1	Pardis Clinic	85	01	673	10.8	10.7	10.0	8.1	2.3
			02	587	11.1	9.2	6.7	5.3	1.4
			03	738	8.0	7.4	6.9	6.1	2.1
			04	714	6.3	5.8	5.8	4.3	1.4
			05	643	6.1	5.7	5.3	3.7	1.2
			06	617	7.8	5.2	4.9	4.1	1.2
			07	739	6.0	6.0	5.7	3.5	1.6
			08	512	8.5	6.4	6.2	4.7	1.4
			09	713	8.8	7.2	6.6	5.6	1.3
			10	738	10.8	7.1	6.7	4.4	1.0
			11	712	7.8	6.7	6.4	5.2	1.5
			12	331	8.3	7.7	6.7	4.9	1.1
	ANNUAL			7817	11.1	10.8	10.8	8.1	-----
0660 023 G 02 013 1023 1	Pardis Clinic	86	01	740	17.1	15.0	12.2	8.7	1.5
			02	667	10.2	8.8	8.8	6.5	2.1
			03	739	11.0	8.0	7.8	6.3	1.4
			04	716	5.8	5.0	4.7	3.6	1.3
			05	737	6.5	5.8	5.4	4.5	1.3
			06	716	5.4	4.9	4.8	3.6	1.0
			07	739	6.8	5.2	4.7	2.8	1.0
			08	740	5.5	5.3	4.9	3.7	1.2
			09	692	7.3	6.2	5.9	5.7	1.3
			10	639	13.3	13.1	12.3	8.0	2.0
			11	714	20.6	12.6	9.8	10.0	1.4
			12	739	23.7	18.5	16.3	9.3	1.4
	ANNUAL			8678	23.7	18.5	16.3	10.0	-----
0660 023 G 02 013 1023 1	Pardis Clinic	87	01	738	14.4	11.7	10.1	6.4	1.0
			02	667	11.5	8.5	7.9	4.9	1.6
			03	644	22.4	19.0	16.3	11.9	1.4
			04	715	8.7	7.9	7.4	6.8	1.2
			05	740	5.7	5.4	5.2	4.4	.10
			06	355	6.3	5.6	5.2	4.3	2.0
			07	566	6.3	6.1	5.9	5.4	1.2
			08	740	8.3	7.3	6.0	4.0	1.3
			09	715	11.8	11.7	11.3	6.4	1.9
			10	738	11.0	10.0	9.9	8.2	2.4
			11	714	15.4	14.5	13.2	9.6	1.9
			12	492	12.4	11.9	11.7	11.1	1.4
	ANNUAL			7824	22.4	19.0	16.3	11.9	-----

TABLE 11b
AQCR 141 - CARBON MONOXIDE
Parts Per Million

County/City Site Code	Site Name/ Location	Yr	Mo.	Num Obs	Max Obs	2nd Max	3rd Max	8-hr Max	Mo. Avg.
Cascade/Great Falls									
0660 023 G 02 013 1023 1	Pardis Clinic	88	01	626	14.6	12.2	10.8	8.0	1.3
			02	692	11.4	10.3	6.9	4.6	1.7
			03	594	5.3	5.3	5.2	4.3	1.2
			04	711	9.9	7.9	7.1	6.0	1.7
			05	740	5.6	5.6	5.1	4.0	1.4
			06	715	6.9	6.2	6.0	4.4	1.6
			07	740	8.2	7.4	6.9	5.0	2.1
			08	702	10.0	8.4	7.4	5.5	2.3
			09	704	10.1	9.1	9.0	5.7	2.0
			10	740	13.6	11.4	11.4	6.4	1.9
			11	716	8.3	7.8	5.9	3.2	.8
			12	738	19.2	12.2	12.0	9.5	1.4
	ANNUAL			8418	19.2	12.1	12.0	9.5	-----
0660 023 G 01 013 1023 1	Pardis Clinic	89	01	739	14.5	9.5	8.5	8.6	1.0
			02	395	12.1	11.8	5.7	4.5	1.5
			03	739	12.7	9.0	9.0	7.7	1.8
			04	716	5.2	5.1	5.1	4.5	1.5
			05	738	4.4	4.0	3.9	2.6	1.0
			06	715	5.4	4.6	4.1	3.0	1.0
			07	740	6.1	5.1	4.6	3.6	1.0
			08	739	5.4	5.0	5.0	3.6	1.1
			09	716	9.4	9.1	8.9	4.7	1.5
			10	611	15.7	10.5	10.2	6.9	1.2
			11	---	----	----	----	----	-----
			12	---	----	----	----	----	-----
	ANNUAL			6848	15.7	10.5	10.2	8.6	-----
0660 025 G 02 013 1025 1	Skyway Conoco	89	01	---	----	----	----	----	-----
			02	---	----	----	----	----	-----
			03	---	----	----	----	----	-----
			04	---	----	----	----	----	-----
			05	---	----	----	----	----	-----
			06	---	----	----	----	----	-----
			07	---	----	----	----	----	-----
			08	---	----	----	----	----	-----
			09	---	----	----	----	----	-----
			10	---	----	----	----	----	-----
			11	508	9.0	8.5	7.8	5.5	1.0
			12	740	9.1	9.0	7.4	5.9	1.3
	ANNUAL			1248	9.1	9.0	7.8	5.9	-----

TABLE 12
AQCR 141 - CO - NUMBER OF EXCEEDANCES
Parts Per Million

County/City Site Code	Site Name/ Location	Yr	Num Obs	Federal Primary 1-Hr 35	Federal Primary 8-Hr 9	Montana Std 1-Hr 23	Montana Std 8-Hr 9
Cascade/Great Falls							
0660 023 G 02 013 1023 1	Pardis Clinic	85	7817	0	0	0	0
		86	8678	0	2	1	2
		87	7824	0	4	0	4
		88	8418	0	1	0	1
		89	6848	0	0	0	0
0660 025 G 02 013 1025 1	Skyway Conoco	89	1248	0	0	0	0

Respirable Particulates (PM-10)

During the first six months of 1988 particulate matter less than 10 microns (PM-10) was monitored at the Downtown site in Great Falls. In July the site was relocated at Fire Station #1. In 1988 the maximum 24-hour observation of 154 $\mu g/m^3$ occurred in February at the Downtown site. This reading was due to unusually high winds which swept through the area. The second highest concentration of 86 $\mu g/m^3$ occurred in September at Fire Station #1 when smoke from regional forest fires were impacting the area.

In 1989 the maximum 24-hour observation of 69 $\mu g/m^3$ occurred in the spring. The weighted annual average of 20 $\mu g/m^3$ was well below the PM-10 standards. Table 13 summarizes the PM-10 data for this region and Table 14 shows the exceedances of the standards.

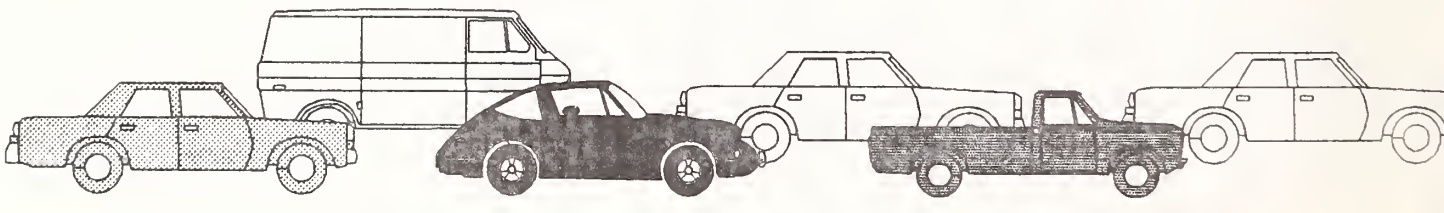


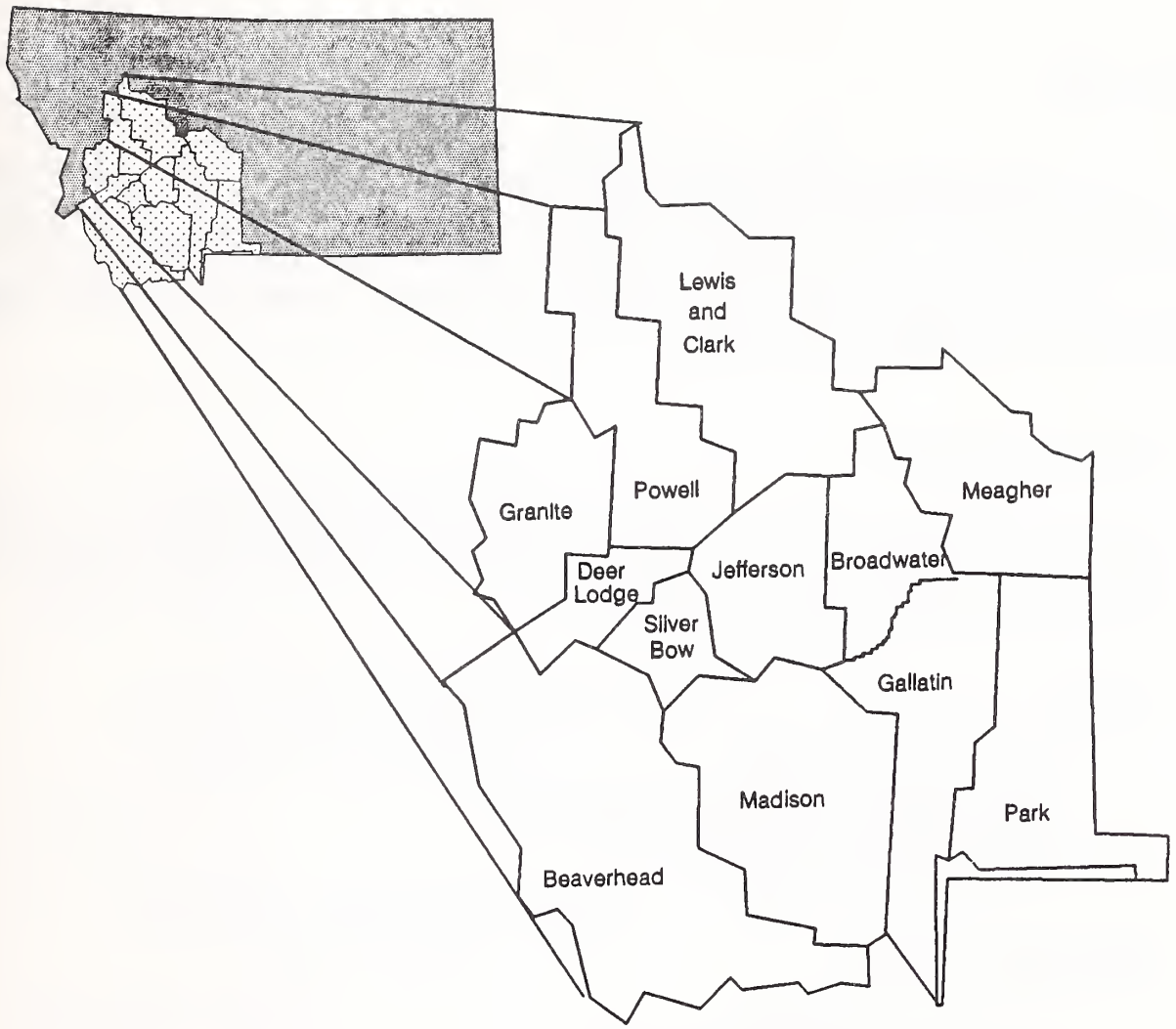
TABLE 13
AQCR 141 - RESPIRABLE PARTICULATES (PM-10)
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Weighted Arith Mean
Cascade/Great Falls							
0660 009 G 01	Fire Station #1	88	28	86*	62	43	22
013 0017	(Began 7/88)	89	54	69	65	60	20
0660 017 G 01	Downtown	85	10	31	18	16	14
013 0017	(Down 6/88)	86	56	73	71	63	30
		87	55	70	66	59	26
		88	21	154*	54	37	32

*Data flagged as exceptional events (High Winds February 21, 1988)
(Forest Fires September 1988)

TABLE 14
AQCR 141 - PM-10 - NUMBER OF EXCEEDANCES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal/State Annual Average >50	24-Hour >150
Cascade/Great Falls					
0660 009 G 01	Fire Station #1	88	27	0	0
		89	54	0	0
0660 017 G 01	Downtown	87	55	0	0
013 0017 2		88	20	0	0



AQCR 142
Southwestern Montana

LOCATION AND PHYSICAL FEATURES

AQCR 142 includes twelve counties located in the southwest corner of the state. The Continental Divide borders the southern edge of the region and continues up through the northern portion. The region contains several highly mineralized mountain ranges separated by broad agricultural valleys. Tributaries for the Missouri, Clark Fork and Yellowstone Rivers have their beginnings in this area.

POPULATION

The 1988 estimated population of AQCR 142 was 188,100 or 23.4 percent of the state population. The main population centers in the region are in Lewis & Clark County (Helena), Gallatin County (Bozeman), and Silver Bow County (Butte). Much of the remaining area is sparsely populated with the primary economic activities ranging from agriculture and forestry to mining.

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Beaverhead County

- Sawmill (particulates)
- Alfalfa pelletizing plant (particulates)
- Talc production (particulates)
- Talc mine (particulates)

Broadwater County

- Sawmill (particulates)
- Lime production (particulates)

Gallatin County

- Cement production (particulates)
- Two talc mills (particulates)
- Sawmill (particulates)
- Building block manufacturing (particulates)

Granite County

- Sawmill (particulates)
- Gold Mine (particulates)

Jefferson County

- Cement production (particulates)
- Gold mine (particulates)
- Zinc mine (particulates)

Lewis & Clark County

Primary lead smelter (particulates, SO_2, lead)
Paint pigment manufacturing (particulates, SO_2, VOC, metals)

Madison County

Three talc mines (particulates)

Meagher County

Alcohol plant (particulates)
Medical waste incinerator

Park County

Municipal solid waste incinerator (particulates)
Several sawmills (particulates, CO)
Gold mine (particulates)

Powell County

Phosphate mining (particulates)
Sawmill (particulates)

Silver Bow County

Elemental phosphorus manufacturing (particulates, fluoride)
Open pit copper mine (particulates)
Gold mine (particulates)

All Counties

Asphalt plants (particulates)
Gravel crushers (particulates)
Home heating devices (particulates, CO)
Automobiles (CO, NOx, re-entrained particulates)
Agricultural activity (particulates)
Wind erosion (particulates)
Open burning (particulates)

MONITORING SITE DESCRIPTIONS

Nine monitoring sites were operating in this region during 1988 and 1989. Table 15 lists the monitoring site descriptions. This includes site codes, site name,

supporting agency, station type, project description, city name and county name, and the parameters or pollutants measured. Site ID codes for both EPA databases (SAROAD and AIRS) are included in the tables.

The primary focus of monitoring in this region is particulate concentrations in several towns, and lead concentrations surrounding a smelter in East Helena.

TABLE 15
AQCR 142 - MONITORING SITE DESCRIPTIONS

SAROAD/AIRS AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0120 002 F 01 031 0002	EAST MAIN CITY BUILDING MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	BOZEMAN GALLATIN	PM10
0160 005 F 01 093 0005	GREELEY SCHOOL #1, SILVER BOW BLVD MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL POPULATION ORIENTED	BUTTE SILVER BOW	PM10
0160 005 F 07 093 0005	GREELEY SCHOOL #2 (COLLOCATED HIVOL) MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL QA-COLLOCATED SAMPLER	BUTTE SILVER BOW	PM10
0720 001 F 01 049 0001	COGSWELL BLDG #1 - LOCKEY AV & ROBERTS ST MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL POPULATION ORIENTED	HELENA LEWIS & CLARK	TSP, PM10
0720 001 F 07 049 0001	COGSWELL BLDG, COLLOCATED HIVOL MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL QA-COLLOCATED SAMPLER	HELENA LEWIS & CLARK	PM10
0760 903 F 02 043 0903	MICROWAVE TOWER - SOUTH OF EAST HELENA MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	MONTANA CITY JEFFERSON	TSP, METALS
0760 905 F 05 043 0905	MONTANA CITY SCHOOL MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL SPECIAL STUDIES	MONTANA CITY JEFFERSON	TSP
0860 714 F 02 049 0714	FIREHALL - 2 EAST PACIFIC ST MONTANA AIR QUALITY BUREAU	CITY CENTER-RESIDENTIAL SOURCE ORIENTED	EAST HELENA LEWIS & CLARK	TSP, METALS
0860 719 F 02 049 0719	HADFIELD - 101 WEST MAIN MONTANA AIR QUALITY BUREAU	SUBURBAN-INDUSTRIAL SOURCE ORIENTED	EAST HELENA LEWIS & CLARK	TSP, PM10, METALS
0860 719 F 07 049 0719	HADFIELD - COLLOCATED MONTANA AIR QUALITY BUREAU	SUBURBAN-INDUSTRIAL QA-COLLOCATED SAMPLER	EAST HELENA LEWIS & CLARK	TSP, METALS
0860 724 F 02 049 0724	DARTMAN FIELD - N OF EAST HELENA MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	EAST HELENA LEWIS & CLARK	TSP, PM10, METALS
0860 726 F 02 049 0726	OLD RAILROAD-HIWAY 518 & ASARCO TRUCK RD MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	EAST HELENA JEFFERSON	TSP, METALS

PARAMETER ABBREVIATIONS:

TSP - TOTAL SUSPENDED PARTICULATES
PM-10 - PARTICULATE MATTER 10 (10 MICROMS AND UNDER)
CO - CARBON MONOXIDE
SO_2 - SULFUR DIOXIDE
WIND - WIND SPEED, WIND DIRECTION AND TEMPERATURE
METALS - LEAD, CADMIUM, ARSENIC, ETC., IN ANY COMBINATION

DATA SUMMARY

Total Suspended Particulates

TSP was monitored at six locations during 1988 and 1989. Due to changes in the particulate standards, many sites that previously monitored TSP are currently monitoring PM-10. The main objective of TSP monitoring in this AQCR is to collect samples for lead analysis.

In 1988 the maximum 24-hour observation of 328 $\mu g/m^3$ occurred at the Hadfield collocated site in East Helena. The reporting site at the same location had a maximum 24-hour observation of 288 $\mu g/m^3$ for this same day in February when the wind was particularly strong. Several other high readings during this year were attributed to smoke from forest fires impacting a large portion of the state. The highest annual geometric average of 66 $\mu g/m^3$ and the highest arithmetic average of 76 $\mu g/m^3$ both occurred at the Hadfield site.

Late in 1989, two more TSP sites were added to the network monitoring the lead smelter. The maximum 24-hour observation for 1989 (185 $\mu g/m^3$) occurred at the Firehall site in East Helena. The highest annual geometric mean of 58 $\mu g/m^3$ occurred at both the Firehall and Hadfield sites. The Hadfield site recorded the highest arithmetic average of 66 $\mu g/m^3$. Table 16 summarizes the last five years of TSP data and Figure 5 shows a five-year comparison of the annual averages for the TSP sites in this region.

TABLE 16a
AQCR 142 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

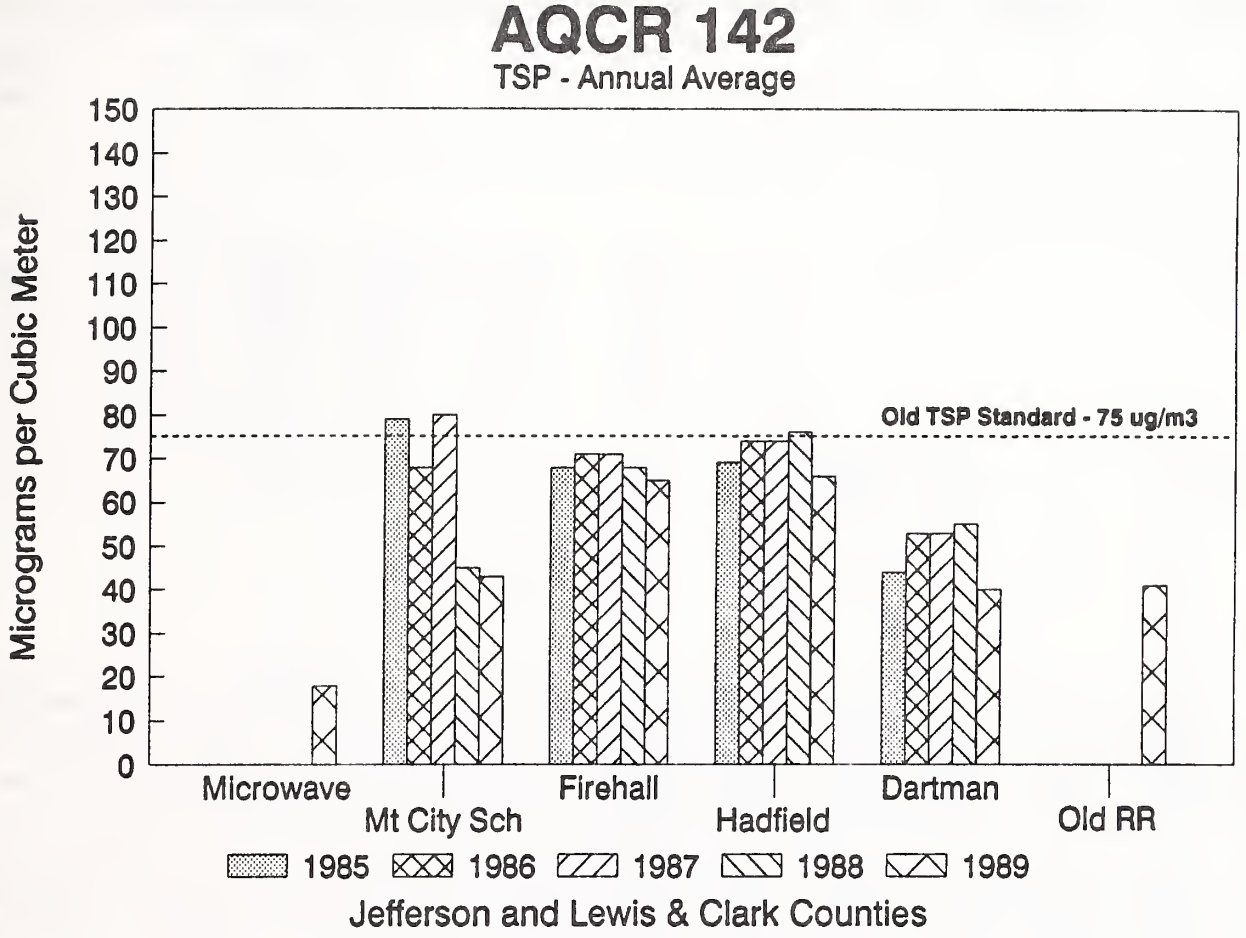
County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Jefferson/Montana City								
0760 903 F 02	Microwave Tower	89	10	66	24	23	18	12
043 0903 1	(Begin 11/89)							
0760 905 F 05	Montana City School	85	60	259	228	221	79	63
043 0905 1	(Down 9/89)	86	59	175	165	165	68	58
		87	59	248	170	153	80	71
		88	54	140	130	92	45	40
		89	39	95	74	71	43	39

TABLE 16b
AQCR 142 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Lewis & Clark/East Helena								
0860 714 F 02	Firehall	85	115	215	207	170	68	59
049 0714 1		87	115	209	178	173	71	60
		87	116	166	155	148	72	63
		88	121	213*	170*	157	68	60
		89	89	185	165	162	65	58
0860 719 F 02	Hadfield	85	115	373	189	173	69	59
049 0719 1		87	119	259	208	193	74	64
		87	117	162	156	142	74	66
		88	121	288*	209*	208	76	66
		89	90	175	154	150	66	58
0860 719 F 07	Hadfield-Collocated	85	115	250	182	162	67	58
049 0719 2		86	118	247	207	185	74	63
		87	118	170	150	137	71	62
		88	122	328*	215*	201	75	65
		89	91	163	152	148	66	58
0860 724 F 02	Dartman Field	85	58	113	106	101	44	36
049 0724		86	60	145	131	128	53	44
		87	59	120	113	112	53	45
		88	55	177*	151	123	55	45
		89	59	133	104	89	40	34
0860 726 F 02	Old Railroad	89	10	120	62	36	41	33
049 0726	(Begin 11/89)							

* Data flagged as exceptional events (High winds - Feb 21, 1988)
(Forest fires - August & September 1988)

Figure 5



Copper

Copper was analyzed from hi-vol filters at two sites in East Helena during 1988 and 1989. One of the sites was discontinued in April of 1988. The maximum 24-hour observation of 18.4 $\mu g/m^3$ in 1988 and 14.02 $\mu g/m^3$ in 1989 occurred at the Firehall site. The annual average was 3.66 $\mu g/m^3$ in 1988 and 2.05 $\mu g/m^3$ in 1989. Copper concentrations at this site seem to be following a downward trend which may be due to control measures implemented by the industries in the area. There is no air pollution standard for copper. Table 17 summarizes the last five years of copper data for this region.

TABLE 17
AQCR 142 - COPPER
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Lewis and Clark/East Helena							
0860 714 F 02	Firehall	85	115	64.52	49.08	36.65	5.88
049 0714 1		86	116	70.72	54.37	37.09	7.98
		87	116	44.51	24.24	22.30	6.15
		88	121	18.41	14.70	13.98	3.66
		89	89	14.02	10.25	10.05	2.05
0860 724 F 02	Dartman Field	88	18	10.18	4.50	3.67	1.74
049 0724 1	(Down 4/88)						

Lead

Lead was analyzed from hi-vol filters at three sites in the East Helena area as a continuing effort to monitor the effects of a primary lead smelter. One of the sites was collocated. During 1988 & 1989 the Firehall site reported the highest concentrations of lead. In 1988 the maximum 24-hour observation was 18.10 $\mu g/m^3$; in 1989 the maximum 24-hour observation was 17.32$\mu g/m^3$. The highest annual average for 1988 was 3.43 $\mu g/m^3$ and 3.06 $\mu g/m^3$ for 1989. The annual average continues to represent about five percent by weight of the particulate concentration. The highest quarterly average for both 1988 and 1989 occurred at the Firehall site during the third quarter of the year; 4.74 $\mu g/m^3$ in 1988 and 3.98 $\mu g/m^3$ in 1989.

Lead concentrations at these three sites exceeded the federal calendar quarter standard all twelve quarters possible of 1988 and ten of twelve quarters in 1989. Table 18 summarizes the last five years of lead data for this region and Table 19 shows the number of exceedances of the lead standards. Figures 6 through 8 show a five-year comparison, by quarter, of the three lead monitoring sites.

Due to the difficulty of meeting the lead standards in this area, the state, local government, and industries, are operating under a strict implementation plan to bring the area into compliance.

TABLE 18
AQCR 142 - LEAD
Micrograms per Cubic Meter

County/City Site Code	Site Name/ Location	Yr	Num Obs	Max Obs	2nd Max	Quarterly Arith Means 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
Jefferson/Montana City									
0760 902 F 02	Microwave Tower	89	10	.17	.15				
043 0903 1	(Begin 11/89)								
Lewis and Clark/East Helena									
0860 714 F 02	Firehall	85	115	17.08	12.99	5.46	3.29	2.25	2.26
049 0714 1		86	116	19.49	14.25	3.17	1.77	2.34	5.15
		87	116	12.75	11.54	3.44	2.35	3.10	4.11
		88	121	18.10	15.70	2.71	2.99	4.74	3.43
		89	89	17.32	14.22	2.32	2.64	3.98	3.06
0860 719 F 02	Hadfield	85	115	10.08	9.05	3.19	2.16	1.86	1.41
049 0719 1		86	121	11.67	11.43	2.09	1.13	1.86	3.70
		87	117	16.42	13.30	3.45	1.92	1.94	2.76
		88	121	14.44	10.08	2.14	2.68	3.40	2.72
		89	90	14.14	5.80	1.73	1.68	2.69	1.87
0860 719 F 07	Hadfield -	85	115	8.50	8.29	3.05	2.06	1.68	1.36
049 0719 3	Collocated	86	119	11.45	11.09	2.00	1.27	1.81	3.71
		87	118	15.32	13.92	3.25	2.01	1.93	2.64
		88	122	13.97	11.52	2.14	2.65	3.53	2.34
		89	91	13.16	5.70	1.72	1.68	2.57	1.98
0860 724 F 02	Dartman Field	85	58	7.14	6.74	2.72	1.54	.61	1.26
049 0724 1		86	60	7.19	6.18	1.60	1.18	1.49	2.94
		87	59	7.25	7.25	2.48	1.28	2.06	2.84
		88	55	13.25	5.70	1.95	2.05	2.49	1.82
		89	59	5.37	4.62	1.20	.58	2.09	1.60
0860 726 F 02	Old Railroad	89	9	6.08	3.25				
049 0726 1	(Began 11/89)								

TABLE 19
AQCR 142 - LEAD - NUMBER OF EXCEEDANCES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal Prim. Cal Qtr. 1.5	Montana Std 90-Day 1.5
Lewis and Clark/East Helena					
0860 714 F 02	Firehall	85	115	4	4
049 0714 1		86	116	4	4
		87	116	4	4
		88	121	4	4
		89	89	4	4
0860 719 F 02	Hadfield	85	115	3	3
049 0719 1		86	121	3	3
		87	117	4	4
		88	121	4	4
		89	90	4	4
0860 724 F 02	Dartman Field	85	58	2	2
049 0724 1		86	60	2	2
		87	59	3	3
		88	55	4	4
		89	59	2	2

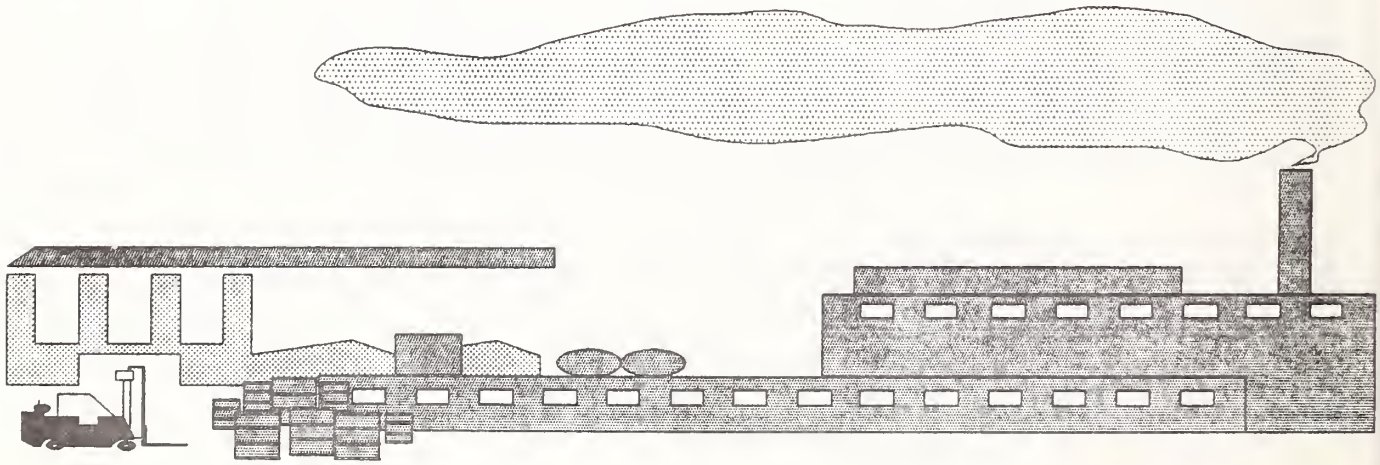


Figure 6

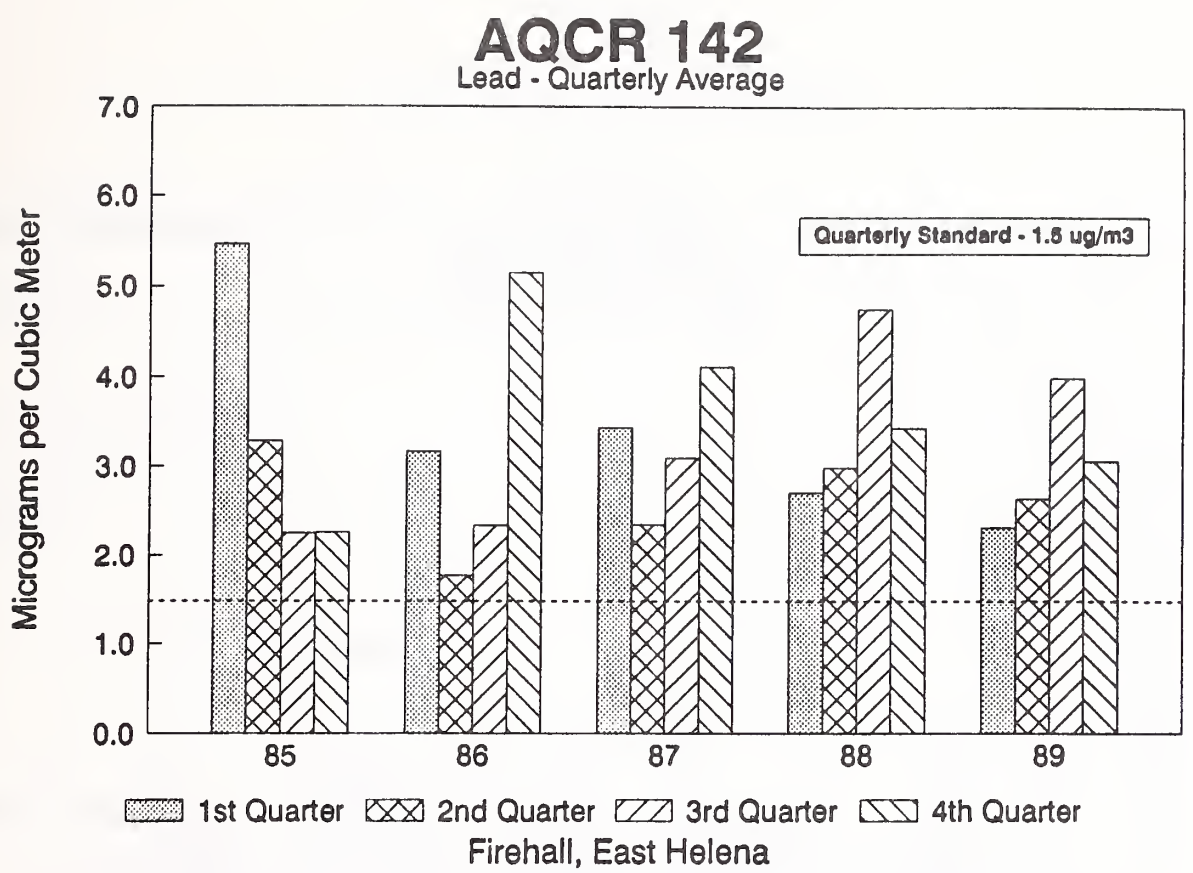


Figure 7

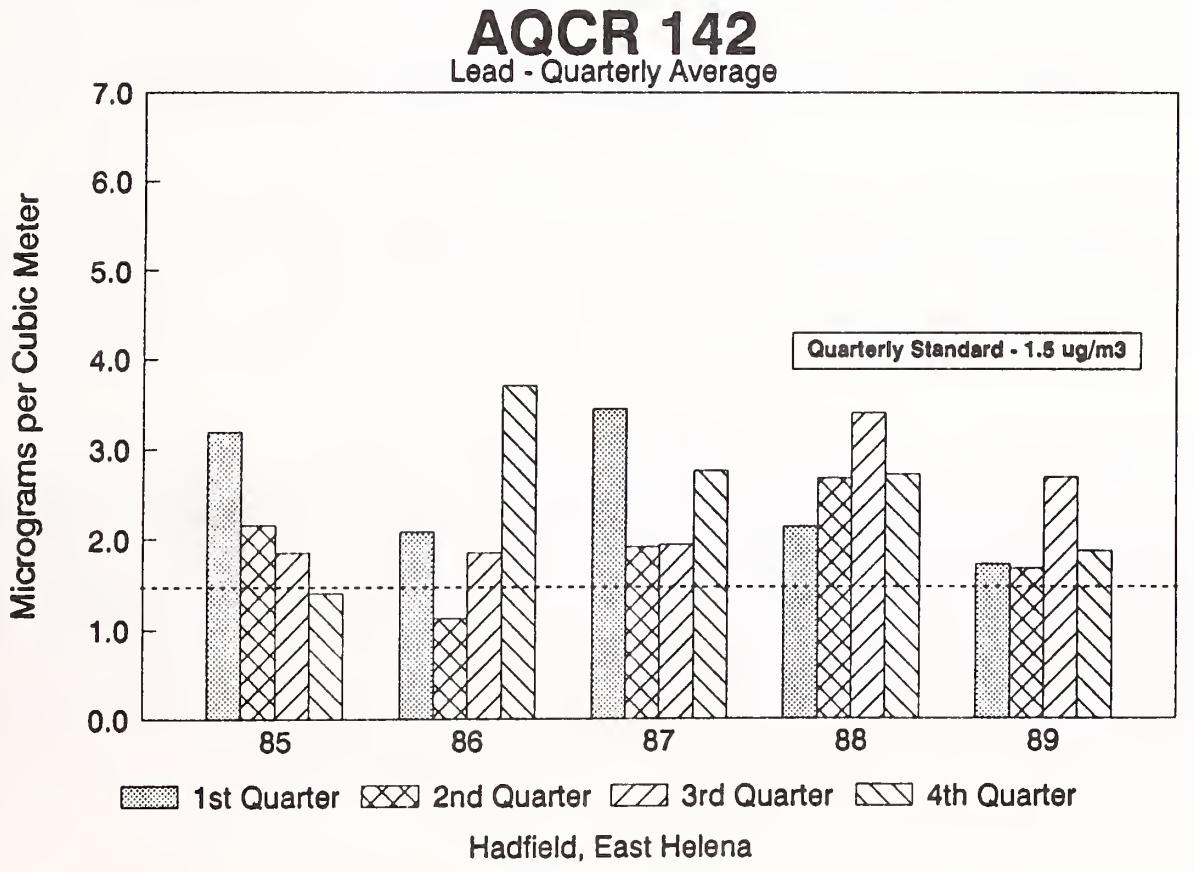
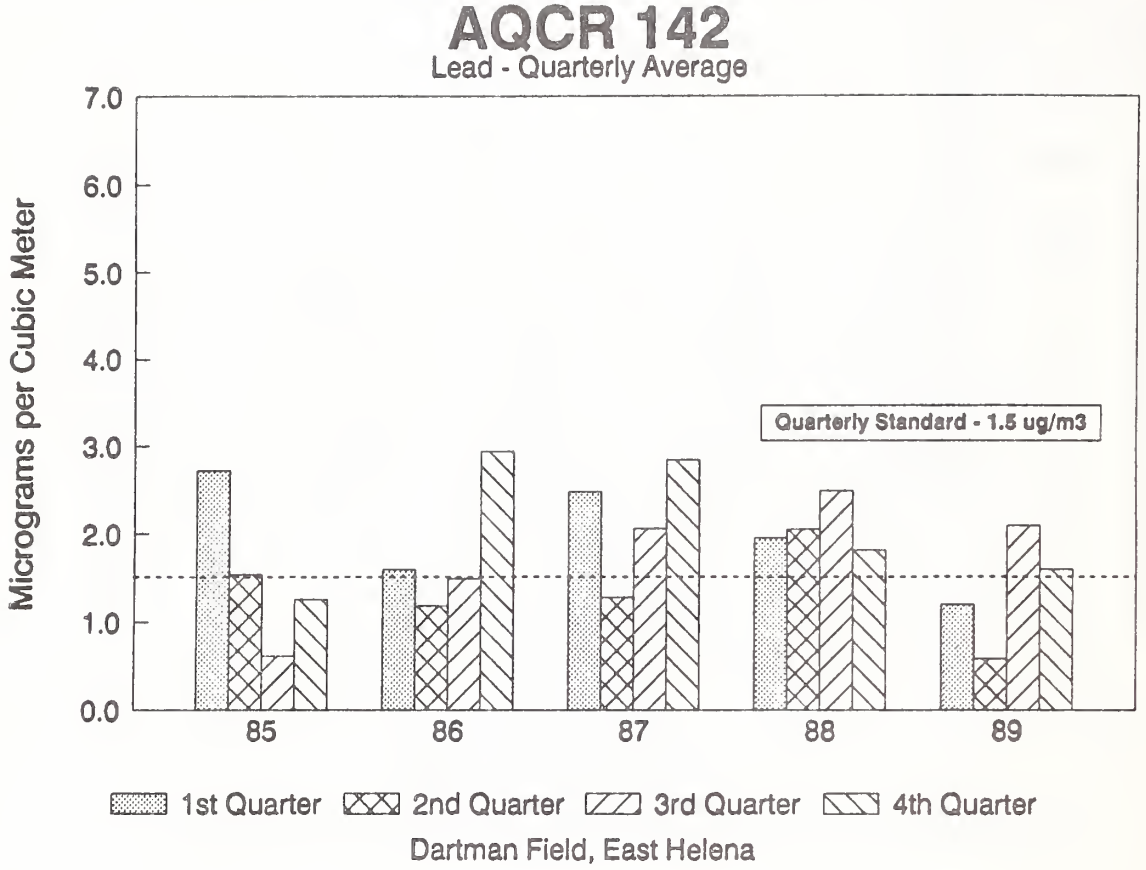


Figure 8



Zinc

Zinc was analyzed from hi-vol filters at the Firehall site in East Helena. In 1988 the maximum 24-hour observation was 6.35 $\mu g/m^3$; in 1989 it was 4.38 $\mu g/m^3$. The annual average for 1988 was 1.21 $\mu g/m^3$ and .85 $\mu g/m^3$ in 1989. There are no air pollution standards for zinc. It is used as an indicator of various processes being used by the area industries. Summary statistics are given in Table 20.

TABLE 20
AQCR 142 - ZINC
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Lewis and Clark/East Helena							
0860 714 F 02	Firehall	85	115	6.86	5.79	4.71	1.55
049 0714 1		86	116	9.99	5.62	4.61	1.41
		87	116	5.19	4.46	4.10	1.36
		88	121	6.35	4.89	3.56	1.21
		89	89	4.38	3.94	3.89	.85

Respirable Particulates (PM-10)

Particulate matter less than 10 microns (PM-10) was monitored at five sites in this region during 1988 and 1989. One of the sites was collocated. The maximum 24-hour observation of 283 $\mu g/m^3$ in 1988 and 158 $\mu g/m^3$ in 1989 occurred at the Greeley School site in Butte. The Greeley School site also reported the highest weighted annual average of the sites not biased by exceptional events. Table 21 summarizes the last five years of PM-10 data for this region.

The Greeley School site in Butte exceeded the 24-hour standard for PM-10 eleven times during 1988 and once in 1989. No sites violated the annual average standard in this region in either year. Table 22 shows the number of exceedances of the PM-10 standards for this AQCR. Figure 9 shows a five-year comparison of the PM-10 weighted annual averages for various sites in this region.

Due to a history of high levels of particulates in the Butte area, it was designated by EPA as a Group I SIP area for PM-10 in 1987. Communities classified as such are required to perform extensive studies and develop plans to bring the area into compliance for a designated pollutant. A Chemical Mass Balance (CMB) study was performed in 1987 and 1988 to identify sources of emissions in the Butte vicinity and to quantify their impact on PM-10 concentrations. Although the CMB study is only one of several studies used to determine emission sources and contributions for Butte, it is interesting to note the types of sources contributing to the area's PM-10 concentrations. Figure 10 contains several graphs showing the apportionment of Butte's PM-10 sources.

TABLE 21
AQCR 142 - RESPIRABLE PARTICULATES (PM-10)
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Weighted Arith Mean
Gallatin/Bozeman							
0120 002 F 01	East Main City Bldg.	85	6	64	52	41	41
031 0002 2		86	32	88	64	64	43
		87	50	61	44	43	27
		88	55	92	78	56	27
		89	55	135	54	45	24
Lewis and Clark/East Helena							
0720 001 F 01	Cogswell Building	85	36	80	64	60	32
049 0001 2		86	55	140	118	105	37
		87	90	71	67	65	25
		88	167	74	70	67	22
		89	156	106	74	73	19
0720 001 F 07	Cogswell Building -	85	36	83	63	61	
049 0001 4	Collocated	86	55	134	117	110	
		87	61	67	59	54	
		88	83	94	91	63	22
		89	81	73	68	50	20
0860 719 F 02	Hadfield	88	72	137*	129*	94	41
049 0719 1		89	168	73	69	69	28
0860 724 F 02	Dartman	88	51	109	96*	79	27
049 0724 1		89	42	46	38	36	13
Silver Bow/Butte							
0160 005 F 01	Greeley School	85	28	302	235	235	48
093 0005 2		86	40	213	212	211	67
		87	138	225	188	186	46
		88	350	283	267	232	39
		89	335	158	134	129	29

*Data flagged as exceptional events - (Forest fires - September 1988)

TABLE 22
AQCR 142 - PM-10 - NUMBER OF EXCEEDANCES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal/State Annual Average >50	Federal/State 24-Hour >150
Gallatin/Bozeman					
0120 0002 F 01	East Main City Bldg.	85	6	0	0
031 0002 2		86	32	0	0
		87	50	0	0
		88	55	0	0
		89	55	0	0
Lewis and Clark/East Helena					
0720 001 F 01	Cogswell Building	85	36	0	0
049 0001 2		86	55	0	0
		87	90	0	0
		88	167	0	0
		89	156	0	0
0720 001 F 07	Cogswell Building -	85	36	0	0
049 0001 4	Collocated	86	55	0	0
		87	51	0	0
		88	83	0	0
		89	81	0	0
0860 719 F 02	Hadfield	88	72	0	0
049 0719 1		89	168	0	0
0860 724 F 02	Dartman Field	88	51	0	0
049 0724 1		89	42	0	0
Silver Bow/Butte					
0160 005 F 01	Greeley School	85	28	0	8
093 0005 1		86	40	1	6
		87	138	0	6
		88	350	0	11
		89	335	0	1

Figure 9

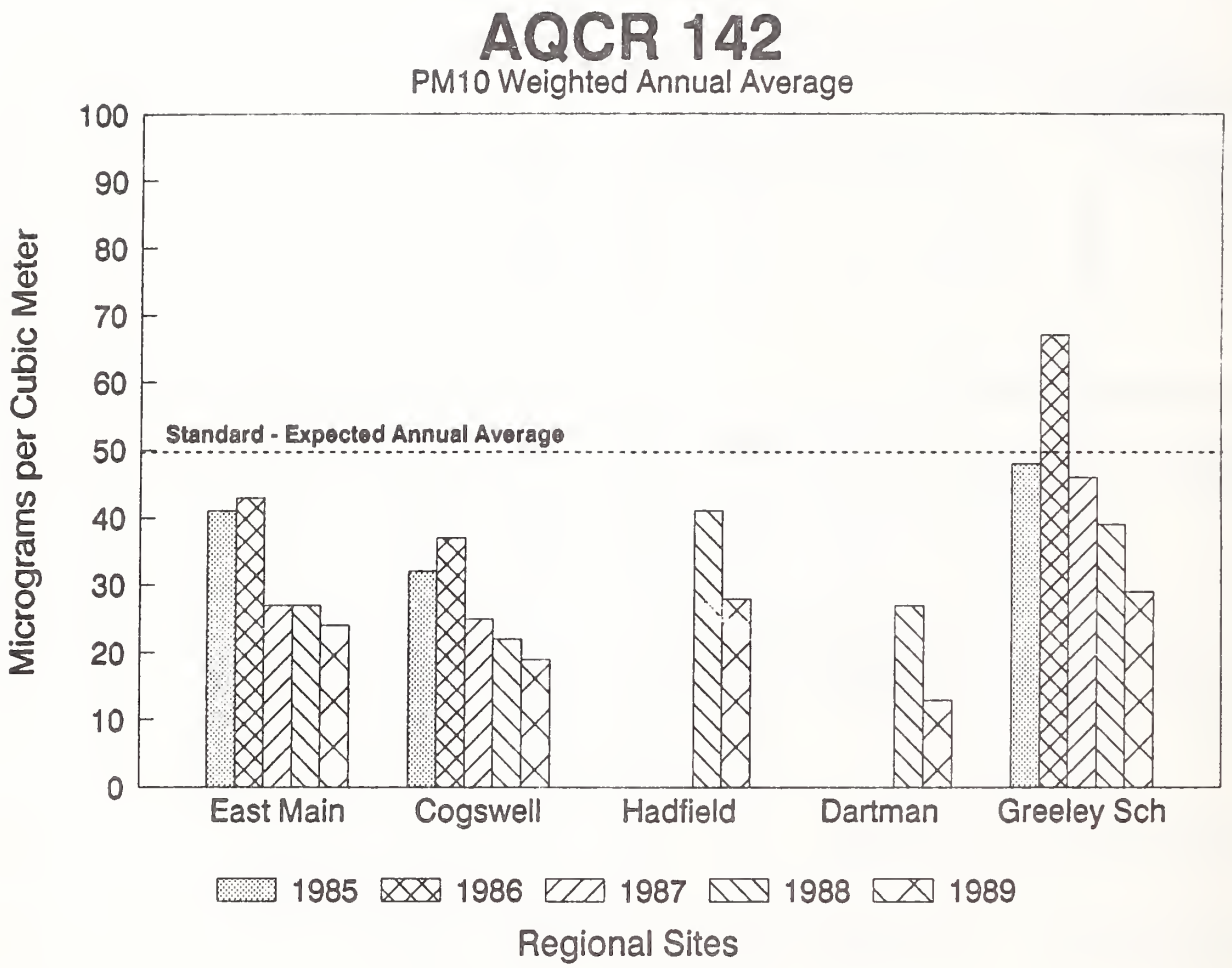
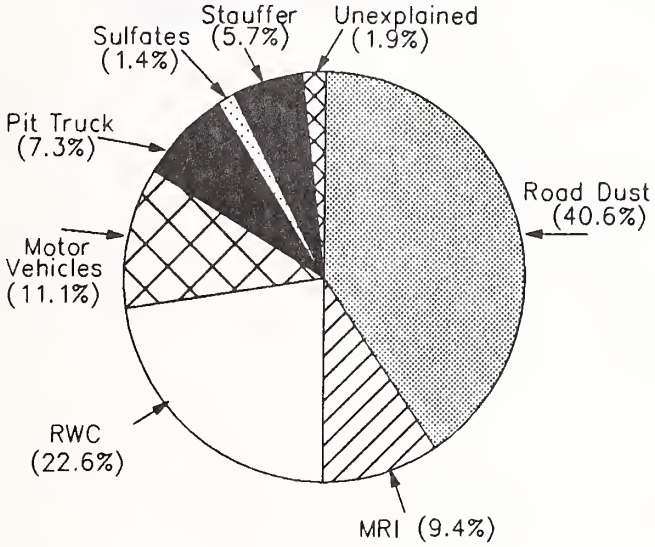

AQCR 142
PM10 Weighted Annual Average
Micrograms per Cubic Meter
100
90
80
70
60
50
40
30
20
10
0
Standard - Expected Annual Average
East Main
Cogswell
Hadfield
Dartman
Greeley Sch
1985
1986
1987
1988
1989
Regional Sites

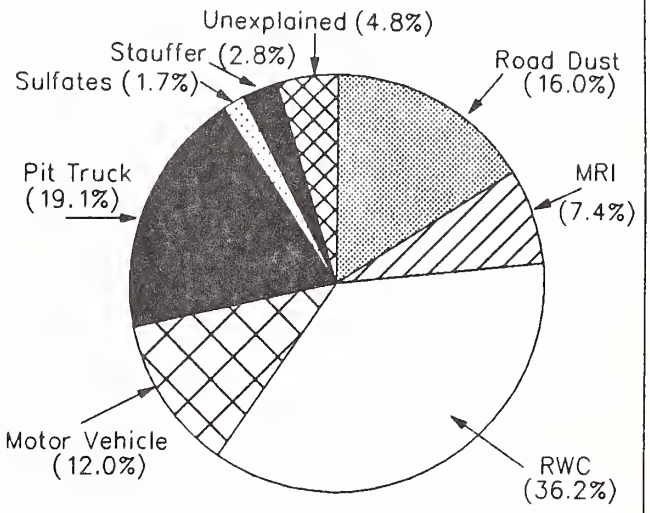
Figure 10

Butte PM-10 Source Apportionment
Total Contribution (0-10 microns)

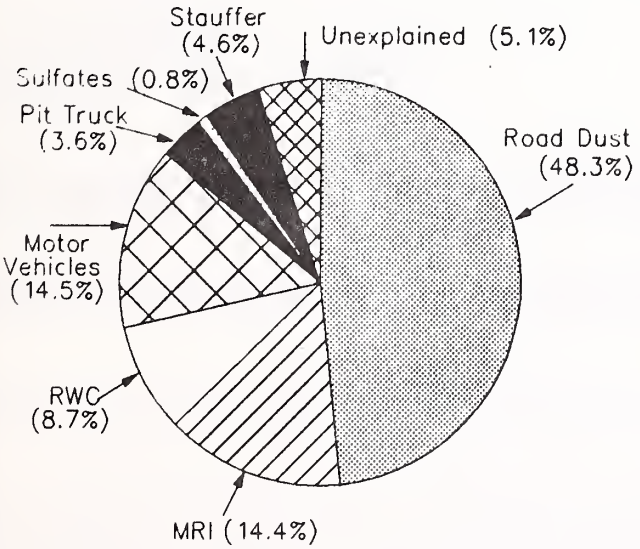
Late Fall 1987
Average Concentration 58.8 ug/m3



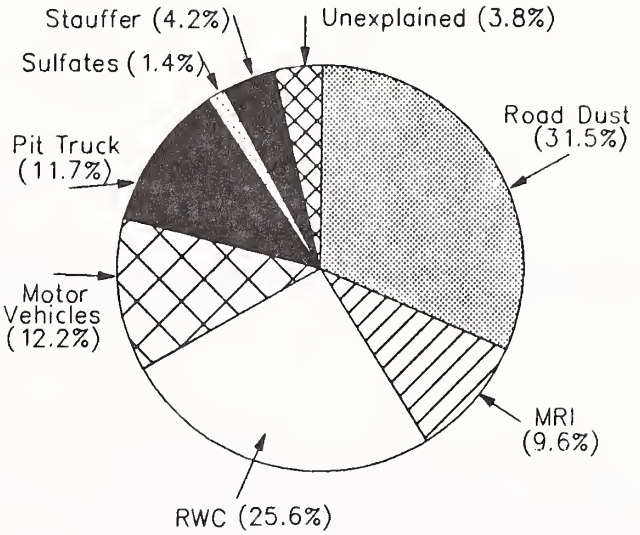
Winter 1987-1988
Average Concentration 53.8 ug/m3



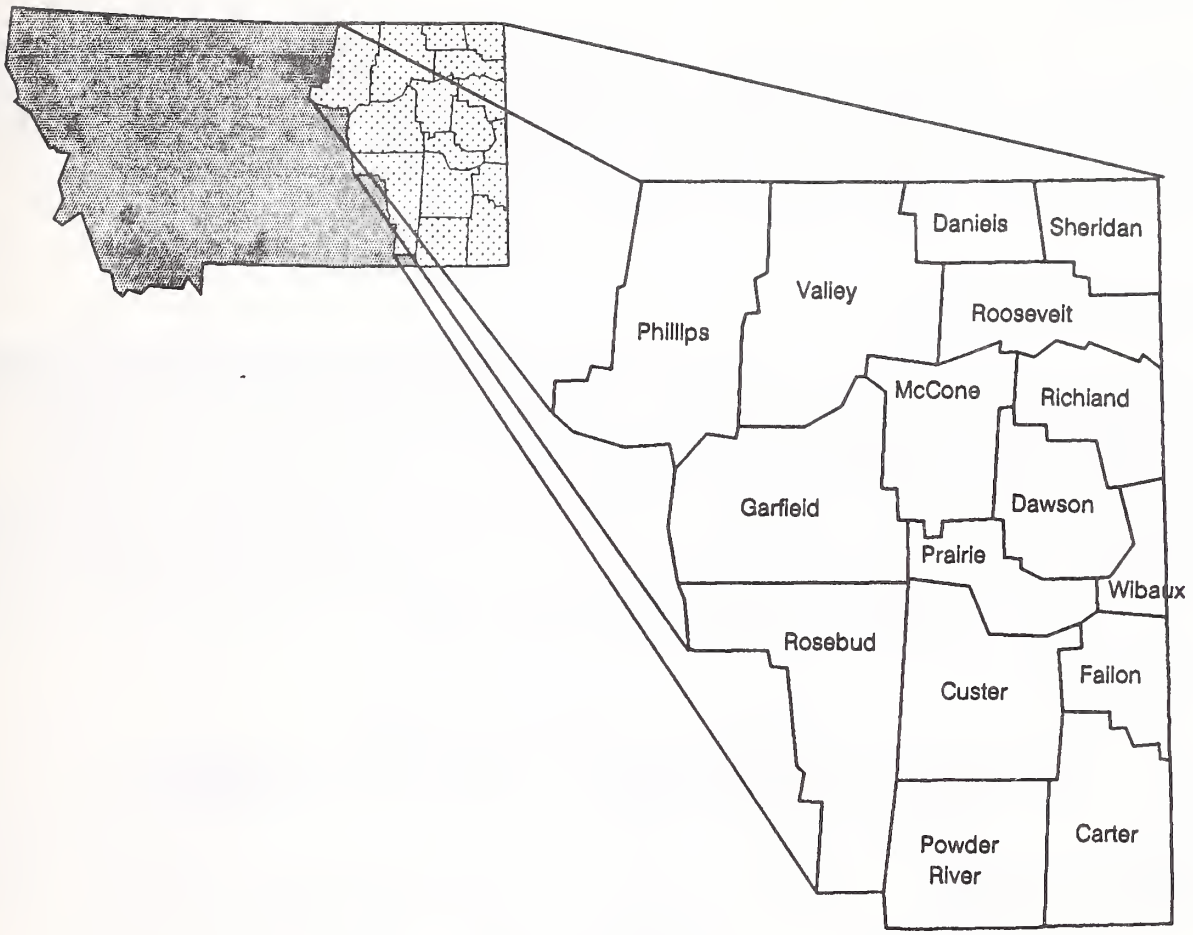
Early Spring 1988
Average Concentration43.4 ug/m3



Study Period 9/87 - 4/88
Average Concentration 52.7 ug/m3



Road Dust
Residential Wood Combustion (RWC)
Pit Truck
MRI (Ore dump,Lime and/or Moly)
Motor Vehicles
Sulfates
Unexplained
Stauffer



AQCR 143
Eastern Montana

LOCATION AND PHYSICAL FEATURES

AQCR 143 includes sixteen counties which comprise the eastern third of the state. Geographical features of the northern half of the region is characterized by glaciated plains (Missouri River area and north) while sedimentary plains encompass the southern half. The Missouri River travels east to west in the northern half; the Yellowstone River travels in a northeast direction through the southern half. The two rivers meet just across the Montana border in North Dakota.

POPULATION

The 1988 estimated population of AQCR 143 was 93,600 or 11.6 percent of the state population. This region is sparsely populated with agriculture, mining, and oil/gas exploration as primary economic influences. The largest populated counties in the region are Richland (Sidney), Custer (Miles City) and Rosebud.

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Custer County

Grain elevator/feed processing (particulates)

Daniels County

Coal-fired power plant (actually in Saskatchewan, Canada) (particulates, SO_2, NOx)

Dawson County

Grain elevator/feed processing (particulates)

Phillips County

Two gold mines (particulates)

Richland County

Sugar beet refinery (particulates, SO_2, NOx)
Coal-fired power plant (particulates, SO_2, NOx)
Two gas sweetening plants (SO_2)
Coal strip mine (particulates)
Oil well flares and vents (SO_2, H_2S)

Roosevelt County

Oil well flares and vents (SO_2, H_2S)

Rosebud County

Two coal strip mines (particulates)
Four coal-fired power plants (particulates, SO_2, NOx)
Sawmill (particulates)

All Counties

Asphalt plants (particulates)
Gravel crushers (particulates)
Agricultural activities (particulates)
Wind erosion (particulates)
Automobiles (CO, NOx, re-entrained particulates)
Open burning (particulates)

MONITORING SITE DESCRIPTIONS

Because of the sparse population in Eastern Montana and generally good meteorological dispersion throughout the area, a minimum of air monitoring was done in this AQCR. Monitoring was limited to the Daniels County area which is downwind from a Canadian power plant. Table 23 lists the monitoring site descriptions for the sites operating during 1988 and 1989 and their corresponding SAROAD and AIRS site codes.

TABLE 23
AQCR 143 - MONITORING SITE DESCRIPTIONS

SAROAD/AIRS AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0340 002 F 03 019 0002	RICHARDSON, 1 MILE NORTH OF SCOBEY MONTANA AIR QUALITY BUREAU	RURAL-NEAR URBAN BACKGROUND	SCOBEY DANIELS	SULFATION RATE
0340 006 F 02 019 0006	FLAXVILLE MONTANA AIR QUALITY BUREAU	RURAL-NEAR URBAN SOURCE ORIENTED	FLAXVILLE DANIELS	SULFATION RATE
0340 007 F 02 019 0007	TV TOWER HILL MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SCOBEY DANIELS	SULFATION RATE
0340 008 F 02 019 0008	SCOBEY DOWNTOWN MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL SOURCE ORIENTED	SCOBEY DANIELS	SULFATION RATE
0340 009 F 02 019 0009	FOUR BUTTES MONTANA AIR QUALITY BUREAU	RURAL-AGRICULTURAL SOURCE ORIENTED	SCOBEY DANIELS	SULFATION RATE

DATA SUMMARY

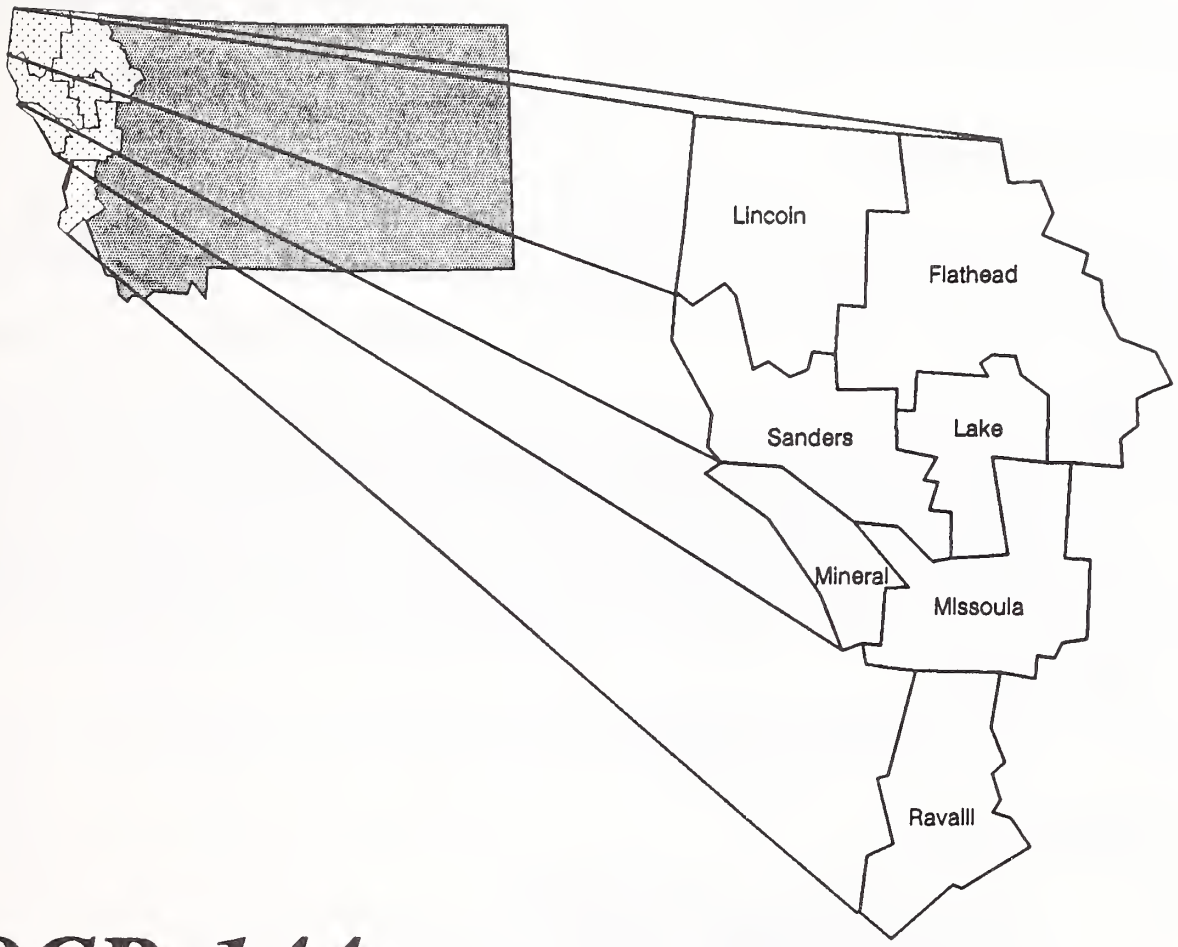
Monitoring for several pollutants in this AQCR was discontinued in 1987 due to a history of low concentrations and good meteorological dispersion. Most of the air monitoring has been directed to the more industrialized and populated areas of central and western Montana. With the adoption of PM-10 standards in 1987, the bureau had to focus its efforts towards those areas experiencing problems with air pollution and bringing those areas into compliance with air pollution standards.

Sulfation Rate

Sulfation rate was monitored at five sites in Daniels County to observe the effects of a coal-fired power plant operating in Canada. The readings remained low during both years with a monthly maximum of 0.06 mg SO_3/100 cm^2/day, which are well below the state's 0.5 guideline. Sulfation rate monitoring continues to be used by the bureau as an indicator of sulfur dioxide levels. Sulfation rate for this region is summarized in Table 24.

TABLE 24
AQCR 143 - SULFATION RATE
Milligrams Sulfur Trioxide per 100 Square Centimeters per Day

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean
Daniels/Scobey							
0340 002 F03	Richardson	87	11	.05	.04	.03	.018
019 0002 1		88	11	.06	.04	.04	.017
		89	9	.02	.01	.01	.005
0340 006 F 02	Flaxville	87	10	.06	.04	.02	.015
019 0006 1		88	10	.07	.05	.04	.021
		89	11	.05	.00	.00	.005
0340 007 F 02	TV Tower Hill	87	11	.05	.04	.03	.019
019 0007 1		88	11	.05	.04	.03	.020
		89	10	.06	.04	.03	.016
0340 008 F 02	Scobey Downtown	87	11	.05	.04	.03	.045
019 0008 1		88	9	.04	.04	.04	.020
		89	11	.06	.02	.02	.009
0340 009 F 02	Four Buttes	87	11	.01	.01	.01	.005
019 0009 1		88	12	.05	.02	.02	.008
		89	9	.00	.00	.00	.000



AQCR 144
Northwestern Montana

LOCATION AND PHYSICAL FEATURES

AQCR 144 includes seven counties located in the northwest corner of the state. The region is entirely west of the Continental Divide and many areas are characterized by steep heavily timbered mountains and narrow mountain valleys. Most of the region is sparsely populated containing few industries and communities. Primary economic influences are timber harvesting, mining and tourism, with agriculture limited to the larger valleys. Precipitation is more plentiful in this area than the rest of the state but atmospheric conditions are often stagnant causing air pollution problems in several communities. The Clark Fork, Flathead, and Kootenai Rivers are the major tributaries, with a large number of rivers and lakes located throughout the region.

POPULATION

The 1988 estimated population of AQCR 144 was 214,500 or 26.5 percent of the state population. The majority of the people in this region live in Missoula County (Missoula) and Flathead County (Kalispell).

POLLUTION SOURCES

Pollution sources and types of pollutants are listed for each county in the region. A final category lists the types of sources that would be expected in all counties in the region. The sources by county are as follows:

Flathead County

- Aluminum reduction plant (particulates, fluorides)
- Two plywood plants (particulates)
- Particleboard plant (particulates)
- Several sawmills (particulates)

Lake County

- Two sawmills (particulates)

Lincoln County

- Copper/silver mine (particulates)
- Vermiculite mine (particulates)
- Plywood plant (particulates)
- Sawmills (particulates)

Mineral County

- Two sawmills (particulates)

Missoula County

- Plywood plant (particulates)
- Particleboard plant (particulates)
- Several sawmills (particulates)
- Kraft pulp mill (particulates, H_2S, SO_2, NOx)

Ravalli County

- Two sawmills (particulates)

Sanders County

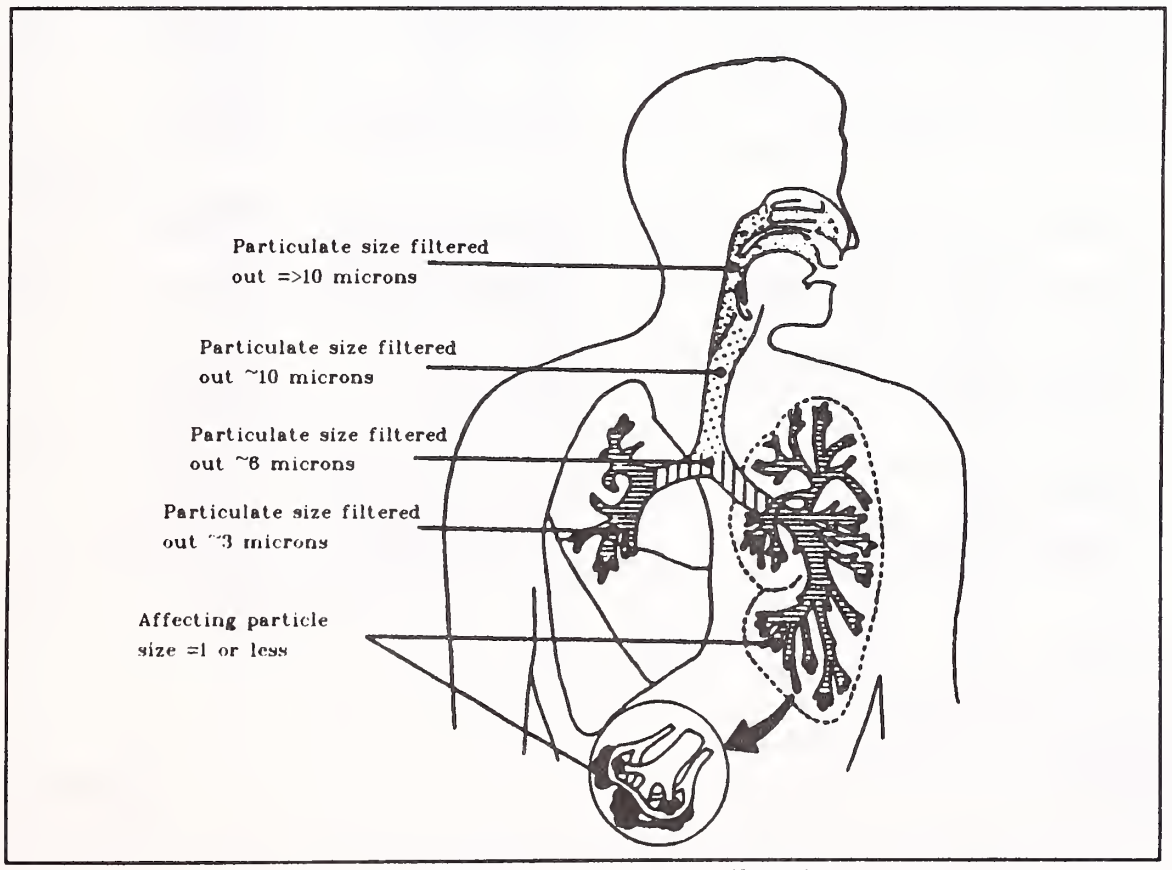
Three sawmills (particulates)
Antimony mine and mill (particulates)

All Counties

Asphalt plants (particulates)
Gravel crushers (particulates)
Automobiles (particulates, CO)
Slash and open burning (particulates, CO)
Residential wood burning (particulates, CO)
Agricultural activities (particulates)

MONITORING SITE DESCRIPTIONS

Due to the geographical and meteorological influence of this region's mountain valleys, the most intensive air monitoring was done in this AQCR. These areas tend to be affected by frequent temperature inversions during the winter and are the most resistant to control measures. Table 25 lists the monitoring site descriptions. This includes site codes, site name, supporting agency, station type, project description, city name and county name, and the parameters or pollutants monitored in 1988 and 1989.



Particulate Size and the Filtration
Capability of the Human Pulmonary System

TABLE 25
AQCR 144 - MONITORING SITE DESCRIPTIONS

SAROAD/AIRS AREA/SITE CODE	SITE NAME/ADDRESS SUPPORTING AGENCY	STATION TYPE PROJECT DESCRIPTION	CITY COUNTY	PARAMETER
0270 003 F 01 029 0003	JR HIGH SCHOOL, 500 4TH AVENUE NORTH MONTANA AIR QUALITY BUREAU	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	COLUMBIA FALLS FLATHEAD	PM10
0800 015 F 01 029 1015	UNIVERSAL ATHLETIC - 226 MAIN STREET MONTANA AIR QUALITY BUREAU	SUBURBAN-COMMERCIAL POPULATION ORIENTED	KALISPELL FLATHEAD	PM10
0900 012 F 01 053 0012	LINCOLN CO COURTHOUSE, 418 MINERAL AVE MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	LIBBY LINCOLN	PM10
0900 012 F 07 053 0012	LINCOLN CO COURTHOUSE - COLLOCATED MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL QA-COLLOCATED SAMPLER	LIBBY LINCOLN	PM10
0900 017 F 05 053 0017	HORELICK RESIDENCE, 707 MICHIGAN AVENUE MONTANA AIR QUALITY BUREAU	CITY CENTER-INDUSTRIAL SPECIAL STUDIES	LIBBY LINCOLN	DUSTFALL, COMBUSTIBLE DUSTFALL
0940 005 F 01 053 1005	LINCOLN ELECTRIC CO-OP - S OF HIWAY 93 MONTANA AIR QUALITY BUREAU	RURAL-COMMERCIAL POPULATION ORIENTED	EUREKA LINCOLN	PM10
1060 001 F 05 061 0001	COX RESIDENCE MONTANA AIR QUALITY BUREAU	RURAL-INDUSTRIAL SPECIAL STUDIES	ST. REGIS MINERAL	DUSTFALL, COMBUSTIBLE DUSTFALL
1080 005 G 02 063 0005	MALFUNCTION JCT, SOUTH, BROOKS, RUSSELL MISSOULA CITY/COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL SOURCE ORIENTED	MISSOULA MISSOULA	CO, WIND
1100 016 G 02 063 0016	STONE CONTAINER #2-WELL FIELD MISSOULA CITY-COUNTY HEALTH DEPARTMENT	RURAL-INDUSTRIAL SOURCE ORIENTED	MISSOULA MISSOULA	TSP
1100 024 G 01 063 0024	BOYD PARK, WASHBURN & ERNEST MISSOULA CITY-COUNTY HEALTH DEPARTMENT	SUBURBAN-RESIDENTIAL POPULATION ORIENTED	MISSOULA MISSOULA	CO, PM10
1100 024 G 07 063 0024	BOYD PARK, WASHBURN & ERNEST MISSOULA CITY-COUNTY HEALTH DEPARTMENT	SUBURBAN-RESIDENTIAL QA-COLLOCATED SAMPLER	MISSOULA MISSOULA	PM10
1100 031 G 01 063 0031	HEALTH DEPARTMENT, 301 WEST ALDER MISSOULA COUNTY HEALTH DEPARTMENT	CITY CENTER-COMMERCIAL POPULATION ORIENTED	MISSOULA MISSOULA	PM10
1100 034 G 02 063 0034	STONE CONTAINER #1A - MOCCASIN LANE MISSOULA COUNTY	RURAL-INDUSTRIAL SOURCE ORIENTED	FRENCHTOWN MISSOULA	TSP
1100 034 G 07 063 0034	STONE CONTAINER #1A - COLLOCATED MISSOULA COUNTY	RURAL-INDUSTRIAL QA-COLLOCATED SAMPLER	FRENCHTOWN MISSOULA	TSP
1400 003 F 01 089 0003	SANDERS COUNTY COURTHOUSE MONTANA AIR QUALITY BUREAU	CITY CENTER-COMMERCIAL POPULATION ORIENTED	THOMPSON FALLS SANDERS	PM10

PARAMETER ABBREVIATIONS:

TSP - TOTAL SUSPENDED PARTICULATES
PM10 - PARTICULATE MATTER 10 (10 MICROMS AND UNDER)
CO - CARBON MONOXIDE
SO2 - SULFUR DIOXIDE
WIND - WIND SPEED, WIND DIRECTION AND TEMPERATURE

Total Suspended Particulates

Due to changes in the particulate standards, most sites which monitored TSP in the past are currently required to monitor PM-10. TSP was monitored at two sites in the Missoula area during 1988 and 1989. One of the sites was collocated. These sites were operated by Missoula County staff to monitor the effects of a kraft paper plant on particulate levels in the Missoula valley.

The maximum 24-hour observation for 1988 (143 $\mu g/m^3$) and 1989 (127$\mu g/m^3$) occurred at the reporting site at Stone Container #1A. This site also recorded the highest annual averages for both years. The last five years of TSP data for this area is summarized in Table 26.

TABLE 26
AQCR 142 - TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Arith Mean	Geom Mean
Missoula/Missoula								
1100 016 G 02	Stone Container #2	85	90	105	87	87	34	28
063 0016 1		86	90	109	107	70	30	22
		87	97	141	135	126	38	29
		88	83	98	92	86	33	26
		89	44	95	74	72	35	31
1100 034 G 02	Stone Container #1A	87	13	90	84	71	43	33
063 0034 1		88	84	143	134	116	56	45
		89	51	127	124	123	51	40
1100 034 G 07	Stone Container #1A-	87	7	111	76	69	54	43
063 0034 2	Collocated	88	35	161	122	112	54	44
		89	27	139	128	114	52	41

Carbon Monoxide

Carbon monoxide was monitored at two sites in the region during 1988 and 1989: Malfunction Junction and Boyd Park in Missoula. The site at Malfunction Junction recorded the maximum hourly observation of 12.9 ppm in 1988 and 14.9 ppm in 1989. Both of these values were within the Montana and Federal 1-hour CO standards.

Malfunction Junction site recorded the maximum 8-hour concentration of 10.2 ppm in 1988 and 12.4 ppm in 1989. These values, combined with an additional high value each year, exceeded the 8-hour CO standard twice in 1988 and twice in 1989. Due to a history of violations of the CO standards, Missoula County has been required to develop control strategies to bring the area into compliance. Sources that contribute to CO are automotive exhaust, wood stoves and fireplaces. Table 27 summarizes the last five years of carbon monoxide data for this region and Table 28 lists the number of exceedances.

TABLE 27a
AQCR 144 - CARBON MONOXIDE
Parts Per Million

County/City Site Code	Site Name/ Location	Yr	Mo.	Num Obs	Max Obs	2nd Max	3rd Max	8-hr Max	Mo. Avg.
Missoula/Missoula									
1080 005 G 02	Malfunction Jct.	86	01	-----	-----	-----	-----	-----	-----
063 0005 1			02	284	10.9	10.4	10.3	8.7	3.1
			03	634	8.8	8.8	8.7	8.8	2.9
			04	393	6.3	6.3	5.5	4.6	1.7
			05	520	6.0	6.0	5.4	4.0	1.7
			06	522	6.5	6.0	5.6	4.4	2.0
			07	262	6.2	5.2	5.1	3.7	1.6
			08	676	7.6	6.9	6.9	4.8	1.7
			09	363	10.4	8.0	8.0	5.6	2.0
			10	582	10.8	10.2	9.8	6.4	2.2
			11	207	11.7	9.6	9.6	7.5	3.1
			12	654	24.5	17.1	12.5	10.0	3.5
	ANNUAL			5097	24.5	17.1	12.5	10.0	-----
1080 005 G 02	Malfunction Jct.	87	01	523	16.1	13.0	12.9	8.5	3.7
063 0005 1			02	668	21.6	15.8	13.7	10.6	3.3
			03	703	10.2	9.7	8.4	7.1	2.1
			04	680	7.5	7.4	6.4	4.5	1.8
			05	239	6.1	4.9	4.7	3.7	1.7
			06	48	4.6	3.8	3.6	2.8	1.2
			07	724	5.8	5.6	5.5	4.5	1.5
			08	739	9.5	8.6	6.4	4.9	2.1
			09	686	78.6	7.1	6.5	5.0	2.0
			10	739	10.9	9.1	8.4	7.2	2.7
			11	714	12.0	11.6	10.7	9.1	3.3
			12	736	13.8	12.5	11.1	10.7	3.3
	ANNUAL			4080	13.4	11.3	10.6	9.2	-----

TABLE 27b
AQCR 144 - CARBON MONOXIDE
Parts Per Million

County/City Site Code	Site Name/ Location	Yr	Mo.	Num Obs	Max Obs	2nd Max	3rd Max	8-hr Max	Mo. Avg.
Missoula/Missoula									
1080 005 G 02	Malfunction Jct.	88	01	733	12.0	11.9	11.4	10.2	3.8
063 0005 1			02	689	11.3	10.5	9.8	8.6	3.1
			03	712	7.3	7.0	7.0	5.4	2.1
			04	712	8.0	7.7	7.1	5.4	1.7
			05	617	7.0	6.9	6.4	6.0	1.9
			06	505	6.9	6.6	6.6	5.6	2.3
			07	675	6.5	6.3	6.0	5.4	2.2
			08	731	9.5	9.2	9.0	5.9	2.3
			09	492	10.7	8.3	8.1	5.6	2.4
			10	283	8.4	8.1	7.5	5.5	2.2
			11	690	11.1	9.9	9.9	7.7	2.8
			12	735	12.9	12.0	11.7	9.7	3.7
	ANNUAL			7574	12.9	12.0	11.7	10.2	-----
1080 005 G 02	Malfunction Jct.	89	01	735	14.9	14.4	14.2	12.4	3.3
063 0005 1			02	664	11.6	10.5	9.6	7.0	2.6
			03	733	10.4	8.8	8.8	7.3	2.6
			04	703	9.3	7.5	6.7	5.0	1.8
			05	701	6.2	6.1	6.0	4.4	1.6
			06	699	4.7	4.5	4.4	3.9	1.5
			07	767	6.2	6.1	5.3	4.3	1.6
			08	739	7.9	7.2	7.2	5.8	2.0
			09	715	8.7	6.9	6.9	5.4	1.9
			10	738	7.4	7.1	7.0	5.0	2.4
			11	715	10.0	8.9	8.4	5.8	2.7
			12	739	12.4	10.4	10.0	9.7	3.3
ANNUAL				8557	14.9	14.4	14.2	12.4	-----
1100 024 G 01	Boyd Park	85	01	733	12.5	11.4	11.0	9.8	1.9
063 0021 1			02	639	11.6	10.8	8.6	7.5	1.8
			03	438	5.3	5.2	5.1	4.0	1.0
			04	443	2.3	2.1	2.0	1.6	0.5
			05	692	2.5	2.4	2.4	1.7	0.6
			06	82	0.1	0.0	0.0	0.0	0.0
			07	-----	-----	-----	-----	-----	-----
			08	-----	-----	-----	-----	-----	-----
			09	-----	-----	-----	-----	-----	-----
			10	-----	-----	-----	-----	-----	-----
			11	-----	-----	-----	-----	-----	-----
			12	710	14.9	12.6	12.0	11.0	2.9
	ANNUAL			3737	14.9	12.6	12.0	11.0	-----

TABLE 27c
AQCR 144 - CARBON MONOXIDE
Parts Per Million

County/City Site Code	Site Name/ Location	Yr	Mo.	Num Obs	Max Obs	2nd Max	3rd Max	8-hr Max	Mo. Avg.
Missoula/Missoula									
1100 024 G 01	Boyd Park	86	01	227	11.8	11.4	11.2	8.8	3.1
062 0024 1			02	434	7.7	7.0	6.3	4.8	1.0
			03	736	7.7	6.3	6.0	4.6	0.9
			04	417	2.8	2.5	2.2	1.6	0.8
			05	513	2.3	2.2	1.5	1.1	0.3
			06	----	-----	-----	-----	-----	-----
			07	----	-----	-----	-----	-----	-----
			08	----	-----	-----	-----	-----	-----
			09	----	-----	-----	-----	-----	-----
			10	591	9.9	9.2	8.8	9.9	1.6
			11	645	9.6	9.4	8.9	6.8	1.3
			12	731	8.8	8.6	8.5	7.3	2.3
	ANNUAL			4294	11.8	11.4	11.2	9.9	-----
1100 024 G 01	Boyd Park	87	01	739	22.6	20.9	12.9	10.9	2.3
062 0024 1			02	553	13.8	13.8	11.1	7.5	2.4
			03	509	3.9	3.5	3.2	2.4	0.8
			04	489	5.0	3.9	3.2	2.2	1.0
			05	---	---	---	---	---	---
			06	---	---	---	---	---	---
			07	---	---	---	---	---	---
			08	---	---	---	---	---	---
			09	---	---	---	---	---	---
			10	333	9.0	8.5	8.3	5.2	2.3
			11	714	6.9	6.8	6.6	5.1	1.8
			12	734	8.5	7.7	7.7	6.4	1.6
	ANNUAL			4071	22.6	20.9	13.8	10.9	---
1100 024 G 01	Boyd Park	88	01	735	11.5	8.6	8.1	5.9	1.8
063 0024 1			02	682	11.1	8.5	6.4	5.1	1.2
			03	729	4.5	3.7	3.6	2.6	.7
			04	713	5.0	3.3	3.2	2.1	.6
			05	----	-----	-----	-----	-----	-----
			06	----	-----	-----	-----	-----	-----
			07	----	-----	-----	-----	-----	-----
			08	----	-----	-----	-----	-----	-----
			09	----	-----	----	----	-----	-----
			10	118	8.0	6.9	6.0	4.8	2.9
			11	681	9.4	6.3	6.3	4.8	1.8
			12	663	9.3	8.9	8.6	8.1	2.6
	ANNUAL			4321	11.5	8.9	8.6	8.1	-----

TABLE 27d
AQCR 144 - CARBON MONOXIDE
Parts Per Million

County/City Site Code	Site Name/ Location	Yr	Mo.	Num Obs	Max Obs	2nd Max	3rd Max	8-hr Max	Mo. Avg.
Missoula/Missoula									
1100 024 G 01	Boyd Park	89	01	734	10.2	9.3	9.2	8.4	1.9
063 0024 1			02	664	10.8	10.1	7.0	5.7	1.5
			03	114	2.9	2.8	2.5	2.2	1.1
			04	----	-----	-----	-----	-----	-----
			05	----	-----	-----	-----	-----	-----
			06	----	-----	-----	-----	-----	-----
			07	----	-----	-----	-----	-----	-----
			08	----	-----	-----	-----	-----	-----
			09	----	-----	-----	-----	-----	-----
			10	----	-----	-----	-----	---- -	-----
			11	382	9.9	7.3	6.6	5.2	2.0
			12	735	8.6	7.7	7.6	5.7	2.2
	ANNUAL			2629	10.8	10.1	9.2	8.4	-----

TABLE 28
AQCR 144 - CO - NUMBER OF EXCEEDANCES
Parts Per Million

County/City Site Code	Site Name/ Location	Yr	Num Obs	Federal Primary 1-Hr 35	Federal Primary 8-Hr 9	Montana Std 1-Hr 23	Montana Std 8-Hr 9
Missoula/Missoula							
1080 005 G 02	Malfunction Junction	86	5097	0	1	1	1
063 0005 1		87	7199	0	6	0	6
		88	7574	0	2	0	2
		89	8557	0	2	0	2
1100 024 G 01	Boyd Park*	85	3737	0	3	0	3
063 0024 1		86	4294	0	0	1	0
		87	4071	0	1	0	1
		88	4321	0	0	0	0
		89	2629	0	0	0	0

*Site runs during the winter stagnation period only

Respirable Particulates (PM-10)

Particulate readings in western Montana are often high due to the meteorological conditions and physical characteristic of the region. Calm winds, temperature inversions, and narrow valleys are combinations which cause pollutants to be trapped and concentrations to increase. Many communities in this region have had difficulty controlling particulates and are under orders to bring their areas into compliance with air pollution standards. Several have been required to conduct studies identifying sources of air pollution and their contribution to particulate concentrations within their communities. Figures 11 and 12 are the results of one such study done in Libby and Kalispell which identify the contributors to the area's particulate concentrations. Additional studies are being conducted in the designated communities and control strategies are being developed to bring the areas into compliance with the PM-10 standards.

Figure 11

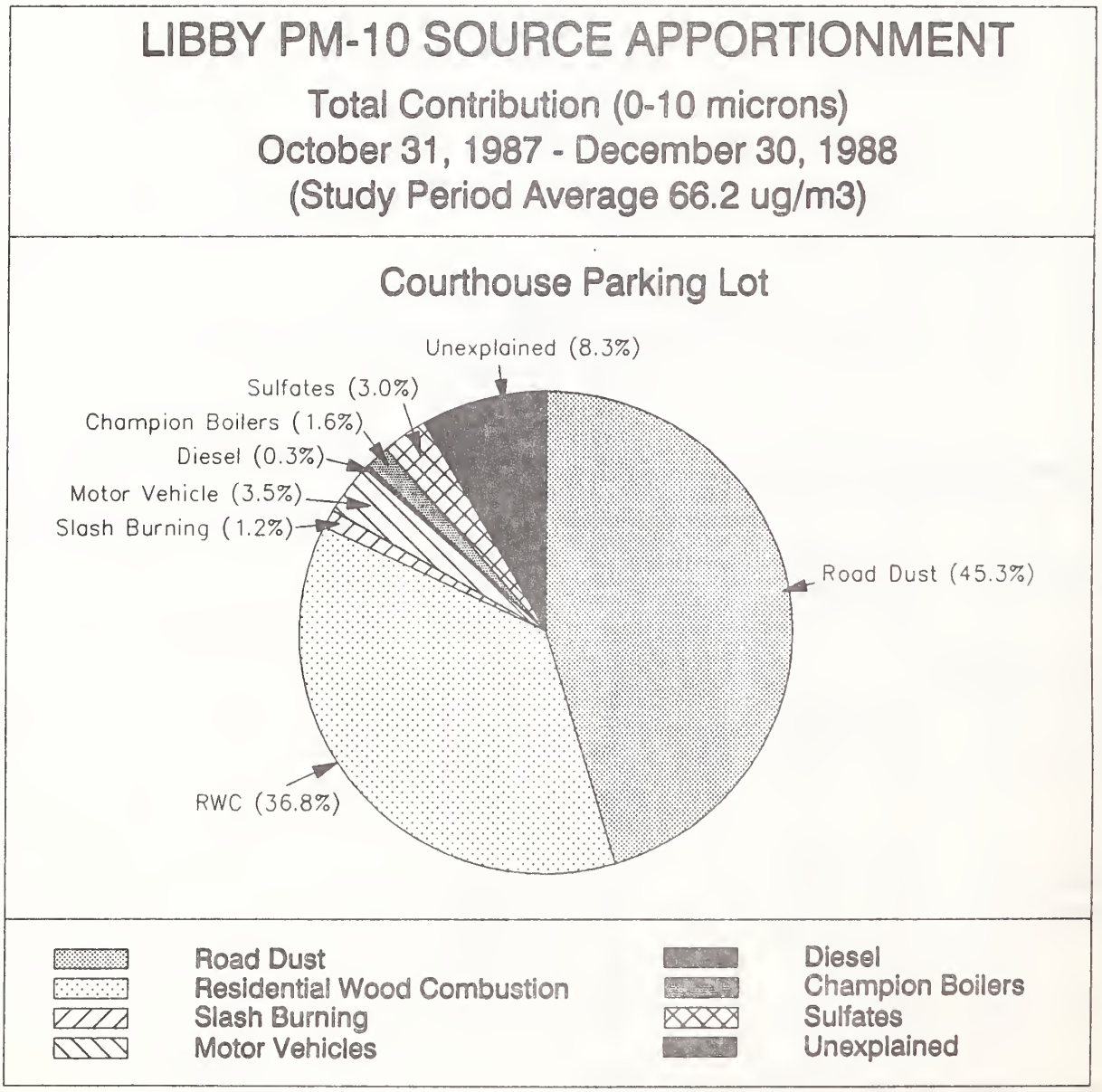
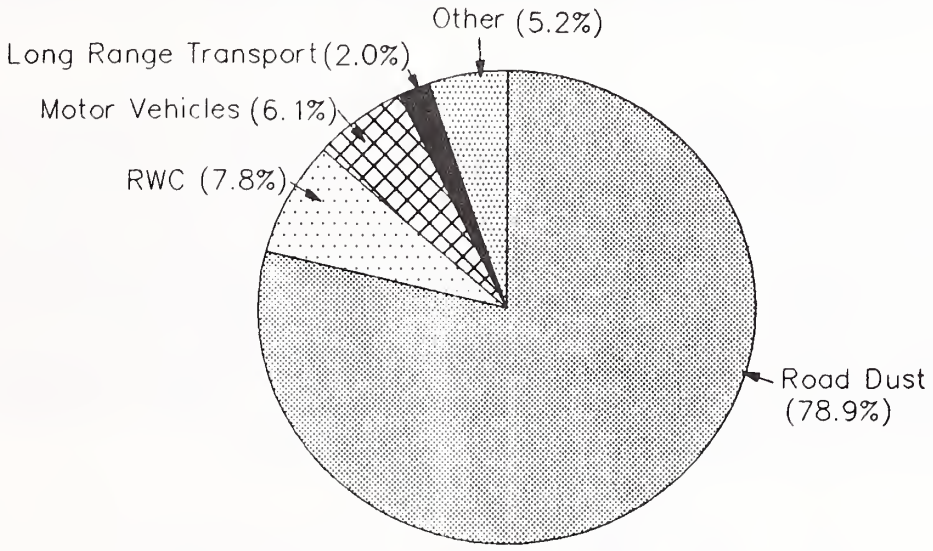


Figure 12

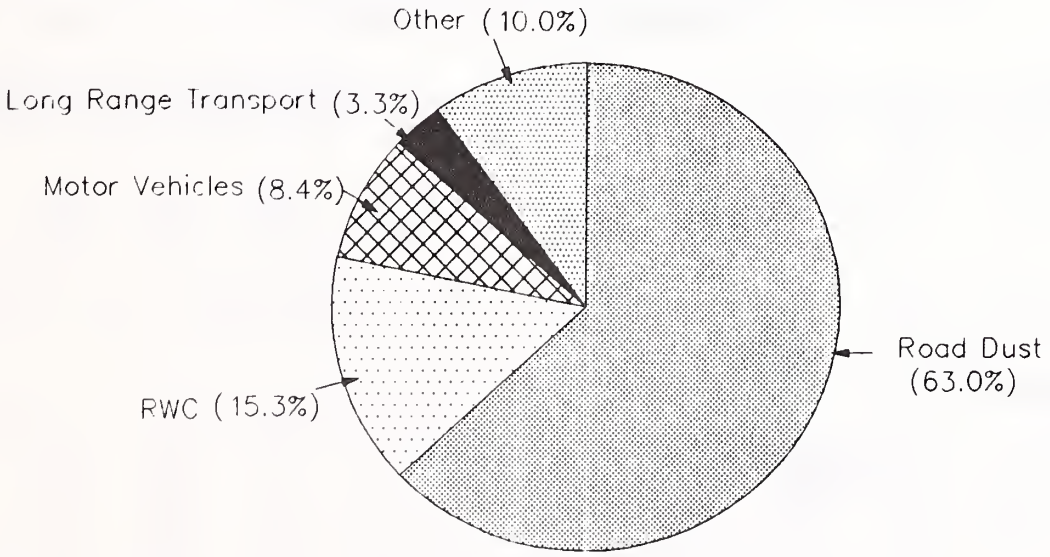
Kalispell PM-10 Source Apportionment

Total Contribution (0-10 microns)
September 1, 1986 - August 30, 1987

Universal Athletics - Average Concentration 56.0 ug/m3



Peterson School - Average Concentration 32.6 ug/m3



- Road Dust
- Residential Wood Combustion (RWC)
- Motor Vehicles
- Long Range Transport
- Others

Particulate matter less than 10 microns (PM-10) was monitored at seven sites in this region during 1988 and 1989. Two of the sites were collocated. In 1988, the maximum 24-hour observation, 393 $\mu g/m^3$, occurred at the Universal Athletic site in Kalispell in June. This high value was due to the demolition of a building near the sampler and was flagged as an exceptional event. The next highest reading not associated with an exceptional event, 256 $\mu g/m^3$, occurred at the Lincoln County Courthouse site in Libby. Several other high readings recorded at Columbia Falls, Kalispell and Eureka were due to smoke from forest fires which impacted a large region of Montana in September of 1988. The highest weighted annual average for 1988, 65 $\mu g/m^3$, occurred at the Lincoln County Courthouse in Libby.

In 1989, the maximum 24-hour observation, 253 $\mu g/m^3$, and the highest weighted annual average, 60 $\mu g/m^3$, occurred at the Lincoln County Courthouse in Libby. The reporting sites in this area exceeded the 24-hour standard 21 times in 1988 and 14 times in 1989. Lincoln County Courthouse at Libby exceeded the annual average standard both years. Libby is located in a narrow and steep mountain valley with very poor ventilation. The compliance status of these communities and their progress toward attainment of the standards is outlined in Appendix F. Table 29 summarizes the last five years of PM-10 data and Table 30 lists the exceedances of the PM-10 standards. Figure 13 graphs the weighted annual average for this region's sites for the last five years.

TABLE 29a
AQCR 144 - RESPIRABLE PARTICULATES (PM-10)
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Weighted Arith Mean
Flathead/Columbia Falls							
0270 003 F 01	Columbia Falls	85	29	77	76	70	40
029 0003 1	Jr. High	86	56	146	115	108	52
		87	86	186	163	145	51
		88	302	188*	134	125	37
		89	303	129	86	86	29
Flathead/Kalispell							
0800 015 F 01	Universal Athletics	85	20	77	68	68	46
029 1015 2		86	57	260	198	159	61
		87	130	119	105	102	46
		88	345	393*	308*	154	45
		89	326	218	203*	167	35

TABLE 29b
AQCR 144 - RESPIRABLE PARTICULATES (PM-10)
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Max Obs	2nd Max	3rd Max	Weighted Arith Mean
Lincoln/Libby							
0900 012 F 01	Lincoln Co. Courthouse	85	26	114	114	98	59
053 0012 2		86	45	171	165	158	84
		87	128	234	226	187	79
		88	345	256	252	239	65
		89	237	253	203	166	60
0900 012 F 07	Lincoln Co. Courthouse-	85	31	157	112	98	59
053 0012 4	Collocated	86	54	322	214	157	85
		87	86	216	214	186	77
		88	172	264	247	215	65
		89	146	217	193	188	59
Lincoln/Eureka							
0940 005 F 01	Lincoln Elec. Coop.	87	28	102	95	90	48
053 1005 1		88	175	169*	121	106	39
		89	165	127	115	111	33
Missoula/Missoula							
1100 024 G 01	Boyd Park	85	5	90	87	76	66
063 0024 2		86	253	238	227	177	51
		87	244	200	162	157	48
		88	323	158	133	129	38
		89	343	194	171	131	36
1100 024 G 07	Boyd Park -	87	63	153	107	97	38
063 0024 3	Collocated	88	112	164	105	103	38
		89	110	125	104	95	33
1100 031 G 01	Health Department	85	24	140	129	126	76
063 0031 2		86	30	143	139	114	40
		87	116	180	169	154	65
		88	344	133	122	114	37
		89	339	239	130	127	37
Sanders/Thompson Falls							
1400 003 F 01	Sanders County	85	26	89	85	84	47
089 0003 2	Courthouse	86	46	113	113	91	51
		87	75	128	125	105	47
		88	247	160	142	132	39
		89	341	219	152	145	36

*Data flagged as exceptional events (Building demolition, forest fires)

TABLE 30a
AQCR 144 - PM-10 - NUMBER OF EXCEEDANCES
Micrograms per Cubic Meter

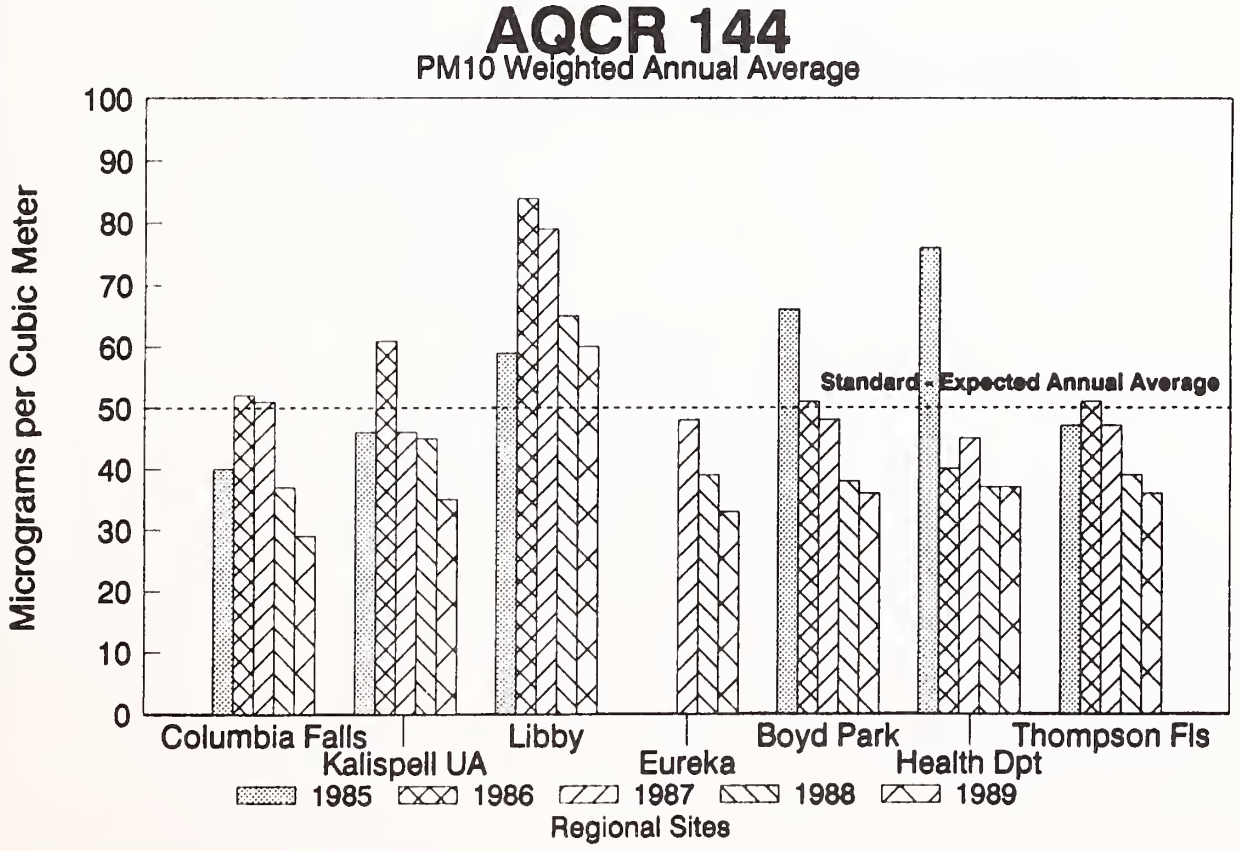
County/City Site Code	Site Name/Location	Yr	Num Obs	Federal/State Annual Average >50	Federal/State 24-Hour >150
Flathead/Columbia Falls					
0270 003 F 01	Columbia Falls	85	29	0	0
029 0003 2	Junior High	86	56	1	0
		87	86	1	2
		88	302	0	1
		89	303	0	0
Flathead/Kalispell					
0800 015 F 01	Universal Athletics	85	20	0	0
029 1015		86	57	1	3
		87	130	0	0
		88	345	0	2
		89	326	0	3
Lincoln/Libby					
0900 012 F 01	Lincoln Co. Courthouse	85	26	1	0
053 0012 2		86	45	1	4
		87	128	1	6
		88	345	1	14
		89	301	1	7
0900 012 F 07	Lincoln Co. Courthouse	85	31		1
053 0012 4	Collocated	86	54		5
		87	86		7
		88	172		6
		89	146		6
Lincoln/Eureka					
0940 005 F 01	Lincoln Elec. Coop.	87	28	0	0
053 1005		88	175	0	1
		89	165	0	0
Missoula/Missoula					
1100 024 G 01	Boyd Park	85	5	1	0
063 0024 2		86	253	1	7
		87	244	0	3
		88	323	0	1
		89	343	0	2

TABLE 30b
AQCR 144 - PM-10 - NUMBER OF EXCEEDANCES
Micrograms per Cubic Meter

County/City Site Code	Site Name/Location	Yr	Num Obs	Federal/State Annual Average >50	Federal/State 24-Hour >150
Missoula/Missoula					
1100 024 G 07	Boyd Park - Collocated	87	63	0	1
063 0024 3		88	112	0	1
		89	110	0	0
1100 031 G 01	Health Department	86	30	0	0
063 0031 2		87	116	0	3
		88	344	0	0
		89	339	0	1
Sanders/Thompson Falls					
1400 003 F 01	Sanders County	85	26	0	0
089 0003 2	Courthouse	86	46	1	0
		87	75	0	0
		88	247	0	1
		89	341	0	1

*Violations of the PM-10 standards are determined by various criteria, taking into account sampling schedules, data recovery, 3-year averages, data excluded due to exceptional events, etc. An exceedance on this table, therefore, does not necessarily denote a violation of the PM-10 standards.

Figure 13



APPENDIX A

Glossary of Air Quality Terms

APPENDIX A

GLOSSARY OF AIR QUALITY TERMS

ABSORPTION

(Engineering) The process of dissolving a gas or one of a mixture of gases in a liquid.

(Bio-medical) The taking up of fluids or other substances by the skin, mucous surfaces, or absorbent vessels.

ACID MIST

A mist of fine aqueous droplets which contain dissolved acidic compounds, such as sulfuric acid.

ACOUSTIC RADAR

A sounding device used to determine the mixing height.

ADIABATIC LAPSE RATE

The change of temperature with height of a parcel of dry air if it is lifted or lowered, with no loss or gain of heat.

ADSORPTION

The adhesion in an extremely thin layer of the molecules of gases or dissolved substances, or liquids, to the surfaces of bodies with which they are in contact.

AEROSOL

Suspended particulate matter consisting of smoke, dusts, and fumes which are either solid or droplets of liquids. Aerosol particles vary in size from well below one micron to approximately 100 microns in diameter.

AMBIENT AIR

That portion of the atmosphere, external to buildings, to which the general public has access.

AMBIENT AIR QUALITY

A physical and chemical measure of the concentration of various chemicals in the ambient atmosphere. The quality is usually determined over a specific time period.

ANTHRACITE

A type of a coal, hard, with high luster, which contains little volatile matter distinguishing it from bituminous coal.

AROMATIC

In organic chemistry, designating a large class of organic compounds which contain benzene rings. The simplest aromatic compound is benzene.

ASTM

ASTM (American Society for Testing Materials) is a voluntary organization of companies and individuals, established for the purpose of setting up standard methods of testing, so that different individuals can obtain comparable test results upon the same sample. ASTM standard test methods are available for almost all types of materials, including some air pollutants. An ASTM apparatus is the specific apparatus designated by ASTM for a specific test.

ATMOSPHERIC PRESSURE (Also called barometric pressure)

The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question. As with any gas, the pressure exerted by the atmosphere is ultimately explainable in terms of bombardment by gas molecules; it is independent of the orientation of the surface on which it acts.

Atmospheric pressure is one of the basic meteorological elements. It is measured by many varieties of barometer, and is expressed in several units. The most common unit used is the millibar (one millibar equals 1000 dynes per cm^2). Unique to the science of meteorology is the use of inches (or millimeters) of mercury; that is, the height of a column of mercury that exactly balances the weight of the column of atmosphere whose base coincides with that of the mercury column. Also employed are units of weight per area and units of force per area. A standard atmosphere has been defined in terms of equivalence to each of the above unit systems, and it is used as a unit itself.

ATTAINMENT AREA

A geographic area in which the quality of the air is better than federal air pollution standards. PSD requirements apply to attainment areas.

ATOMIZING SCRUBBER

A wet collector in which use is made of a liquid medium to increase the size of aerosol particles to facilitate its removal from a gas stream. In an atomizing scrubber, water is introduced at the throat of a venturi through which gas (containing aerosol particles) is moving at high velocity. Units of this type have a high pressure drop, and are used to get high removal efficiencies for particles of relatively small diameters (e.g., below 1.5 microns).

BACT - "Best Available Control Technology"

The term best available control technology means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each such pollutant. [Clean Air Act, Section 169(3)].

BART - "Best Available Retrofit Technology"

An emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by an existing stationary facility. The emission limitation must be established, on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and nonair quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

BAGHOUSE

An enclosure containing many cloth bag filters. Dust laden air entering at the top or bottom of a bag is discharged through the cloth directly to the atmosphere while the solid particles are deposited inside the bag.

BITUMINOUS

A type of coal, soft, which yields considerable volatile matter when heated. Burning this type of coal in open fireplaces or household stoves has caused serious air pollution problems (London, formerly in Pittsburgh and Saint Louis) because of the lack of sufficient temperature above the firebed to burn the volatilized gases and tars (i.e., both gaseous and particulate emissions).

BRONCHITIS

Inflammation of the bronchial tubes (wind pipe), which includes the bronchi (s. bronchus) and the choncia (s. bronchium) and through which air passes to the lungs.

BULK DENSITY

The quotient of the total mass of a mixture (usually liquid plus solid or gas plus solid) divided by the total volume.

CARBON DIOXIDE (CO_2)

A colorless, odorless, incombustible gas, used to make carbonated beverages, dry ice, etc. It is a product of respiration, combustion, fermentation, decomposition and other natural processes, and is always present in the atmosphere.

CASCADE IMPACTOR

A device for separating dust particles from a moving air stream. In principle a dust particle collides or impacts on a solid surface and thus is collected while the air stream moves around the solid surface. An assembly of a series of such surfaces is called a cascade impactor.

CHROMATOGRAPHY

A technique used by chemists to cause the separation of small amounts of chemical compounds in order to determine their identity and quantity.

CIRCULATION PATTERN

The general geometric configuration of atmospheric circulation at a given time and region.

CLASS I AREA

Any area which is designated for the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each national park over 6,000 acres and each national wilderness area over 5,000 acres.

CLASS II AREA

Any area cleaner than federal air quality standards which is designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted in a Class II area.

CLASS III AREA

Any area cleaner than federal air quality standards which is designated for a lesser degree of protection from future air quality degradation. Significant increases in new pollution may be permitted in a Class III area.

CLEAN AIR ACT

A law enacted by Congress to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population.

CRITERIA POLLUTANT

A pollutant for which EPA has established a national ambient air quality standard under Section 109 of the Clean Air Act. Present criteria pollutants are: carbon monoxide, hydrocarbons, lead, nitrogen dioxide, ozone, sulfur dioxide and total suspended particulate.

CLOTH FILTER
A cloth bag filter; see BAGHOUSE

COLLECTION EFFICIENCY
The ratio of the weight fraction of aerosol which is retained in the collector to that which entered the collector. Collection efficiency could be specified in terms of particle numbers or other physical characteristics for special cases.

COMBUSTION
The rapid reaction of carbon containing substances (or other oxygen demanding materials) with oxygen producing a rapid temperature increase and a flame.

COMBUSTION CHAMBER
That part of a furnace or incinerator in which burning takes place.

CONING
A name which describes the approximate shape of a smoke plume in a neutral atmosphere (see FANNING).

CONVECTION
(In meteorology) a mechanical process thermally produced involving the upward and downward transfer of a limited portion of the atmosphere.

CYCLONE COLLECTOR
A device for separating solid particles from gases or liquids. The carrier gas or liquid is made to move in a rapid spiralling motion (cyclonic) throwing the solids by centrifugal force to the walls of the collector.

DEPOSITION VELOCITY
The minimum velocity of a small particle suspended in a moving air stream that will give the particle sufficient momentum to carry it into a target (deposit the particle on a collecting surface). At lower velocities the particle will remain in the air stream and go around the target.

DEW POINT (or dew point temperature)
The temperature to which a given parcel of air must be cooled at constant pressure and constant water vapor content in order for saturation to occur.

DISPERSION
The action of mixing air containing a high concentration of pollutants arising from a pollutant source with the ambient air thereby reducing the ambient pollutant concentration.

DUST COLLECTORS
Any device used to remove particulate matter from exhaust streams.

DUSTFALL

The amount of large particulate matter deposited per unit time per unit area of surface.

ELECTROLYTIC BATH

A container of liquid or molten materials through which an electric current is passed to cause chemical decomposition.

ELECTROSTATIC PRECIPITATOR

A device for collecting dispersed particles. Particle laden air is passed between two surfaces carrying a high electric potential and under the force of the electric field the particles are driven to a collecting electrode and precipitated.

EMPHYSEMA

The presence of air in the alveolar tissue of the lungs due to rupture of the alveoli. Progressive development of this condition leads to enlargement of the lungs and the chest cavity simultaneously with reduced capacity for breathing and efficiency of breathing.

FANNING

The characteristic appearance of a smoke plume emitted under extreme inversion conditions, where little vertical mixing of smoke in the atmosphere takes place (see CONING).

FLUE GASES

All the gases discharged from any stationary combustion process.

FLUE GAS DESULFURIZATION

One of several processes by which sulfur dioxide is removed from the flue gas as a disposal solid, elemental sulfur or sulfuric acid.

FLUORIDE

The generic name of all simple chemical compounds containing fluorine, as sodium fluoride.

FLUORINE

A nonmetallic chemical element, a pale yellow, highly corrosive and toxic gas.

FLUOROSIS

Chronic poisoning by fluorides.

FLY ASH

The non-combustible particles contained in flue gas.

FOSSIL FUELS

Oil, coal or natural gas.

FREE LIFT

The actual lifting force of an inflated balloon, usually expressed in grams. The free lift plus the weight of the balloon and attached equipment is the total lift.

FUME

A fume is formed by sublimation of solid particles from the gaseous state. The term is frequently used to describe suspensions of very small (submicron) particles.

GASIFICATION

The process of converting solid or liquid fossil fuels to gaeous fuel, usually with the elimination of sulfur.

GRAVITY SETTLING

The application of gravitational force to cause solid particles to drop out of the air. Practically it is useful for removing only particles larger than 50 microns in size.

HALOGEN

Any of the five very active, nonmetallic chemical elements: fluorine, chlorine, bromine, iodine, and astatine.

HYDROCARBON

Any of the class of compounds consisting solely of hydrogen and carbon.

1. Paraffins whose molecules contain the maximum possible of hydrogen.
2. Aromatics, whose molecules contain benzene rings.
3. Naphthenes, whose molecules are ring shaped.
4. Olefins, whose molecules contain double bonds.

HYDROFLUORIC ACID

A water solution of hydrogen fluoride. In the gaseous state, hydrogen fluoride is colorless, corrosive, and poisonous.

HYDROGEN

The most simple chemical element and the lightest of all gases. It is found chiefly combined with oxygen to form water; also found in acids, bases, hydrocarbons, etc.

INCINERATORS

Any device to burn solid and combustible liquid residues or wastes in order to reduce their bulk. The ash residue may be used for landfill or dumped at sea. Flue fed incinerators are those where the garbage or refuse is supplied to the combustion chamber through the same flue used for discharge of the products of combustion. A power generating or combination incinerator is one in which the heat from refuse combustion is used to generate steam. Primary air is usually supplied with the material being burned. Secondary air is usually supplied to complete combustion of incompletely burned gaseous fractions over the fuel bed. Tertiary air may be supplied to further improve combustion in a secondary chamber.

INCREMENTS

The amount of additional pollution, beyond already existing background levels, which may be allowed in a particular PSD area. The size of allowable increment varies with whether the area is Class I, Class II or Class III.

INVERSION

A meteorological condition in which the temperature of the atmosphere rises with increased elevation instead of falling; a negative temperature lapse rate.

INVERSION LAYER

A layer in the atmosphere through which the temperature remains constant or increases with altitude.

ICAP - Inductive Coupled Argon Plasma

Measurement of emission spectra which is excited by radiofrequency in a plasma. The emissions from analytes will produce signals on a photomultiplier tube.

INTEGRAL VISTA

A view perceived from within the mandatory Class I Federal area of a specific landmark or panorama located outside the boundary of the mandatory Class I federal area.

ISOKINETIC

Having the same speed and direction. When sampling gas streams for certain purposes it is important that the gas flow into the sampler be of the same speed and direction as the main gas stream. This is called isokinetic sampling.

LAER - Lowest Achievable Emission Rate

A requirement applying to proposed new or modified major stationary sources in nonattainment areas. LAER means the rate of emissions which reflects:

a. the most stringent emission limitation which is contained in the (SIP) of any state for such class or category of source . . . or

b. the most stringent emission limitation which is achieved in practice . . ., whichever is more stringent.

LAPSE RATE

The change in an atmospheric variable, usually temperature, with height.

LIGNITE

A naturally occurring coal-like material often having a distinct woody texture.

MACROMETEOROLOGY

Large-scale weather events as opposed to local micrometeorological events.

MERCAPTAN

One of a class of sulfur-containing organic chemical compounds (R-SH), which have an extremely offensive odor.

METEOROLOGY

The science dealing with the atmosphere and its phenomena, particularly relating to weather.

METHANE

The first of the series of hydrocarbons (CH). It is a colorless, odorless, flammable gas and is the chief constituent of natural gas.

MICROMETEOROLOGY

The science of small-scale weather events.

MICRON (MU)

A metric unit of measure of length equal to one millionth of a meter and to one thousandth of a millimeter. This unit is often used for describing sizes of airborne particles and is commonly designated by the Greek letter μ (mu).

MIXING HEIGHT (or mixing depth)

The thickness of the atmospheric layer, measured from the surface upward, through which pollutants are presumed to mix by virtue of convection caused by daytime heating at the surface. The designation of mixing height implies the existence of an inversion, in which case the mixing height is also the height of the inversion base.

NECROSIS

Gradual decay in trees or plants.

NESHAPS - National Emission Standards for Hazardous Pollutants

EPA has adopted emission standards for sources of asbestos, beryllium, vinyl chloride, and mercury.

NITROGEN OXIDES

Compounds of nitrogen including N_2O, NO, NO_2, NO_3, N_2O_3, N_2O_4, N_2O_5. Those most commonly encountered in the atmosphere are nitrous oxide (N_2O), a normal constituent of the air, and nitric oxide (NO) and nitrogen dioxide (NO_2) which are classified as pollutants.

NONATTAINMENT AREA

A geographic area in which the quality of the air is worse than federal air pollution standards. PSD requirements do not apply in nonattainment areas.

NSPS - New Source Performance Standards

EPA emission standards for certain categories of new or modifed air pollutant sources.

OPACITY

A measurement of visible emissions defined as the degree, expressed in percent, to which emissions reduce the transmission of light and obscure the view of an object in the background.

OXIDANT

Any chemical element or compound which will cause any other element to increase in positive valence in a chemical reaction. Less precisely, any chemical element or compound, e.g. NO_2, including oxygen, which has the same effect as oxygen in a chemical reaction. In photochemical smog, the sum of all compounds detected by reaction with reducing agent, e.g., potassium iodide solution.

OZONE

A form of oxygen, O_3, having three atoms of oxygen to the molecule. It is found in the atmosphere in minute quantities and is a powerful oxidizing agent. It is a toxic constituent of photochemical smog.

PARAFFINS

A class of saturated hydrocarbons characterized by their chain-like molecular structure. See HYDROCARBON.

PARTICLES

Any solid matter emitted by a pollutant source. It is composed of settleable matter (which will settle as dust within a reasonable period of time) and suspended matter (which remains suspended in the atmosphere until washed out by precipitation, deposited by impaction, or some other process).

PARTICULATE MATTER

Finely divided solids or liquids. See AEROSOL.

PHOTOCHEMICAL SMOG

Air pollution resulting from light-induced reaction between certain organic materials and nitrogen dioxide.

PILOT BALLOON

A small balloon whose ascent is followed by a theodolite in order to obtain data for the computation of the speed and direction of winds in the upper air.

PILOT-BALLOON OBSERVATION (Commonly pibal)

An observation method for winds aloft; that is, the determination of wind speeds and directions in the atmosphere above a station. This is done by reading the elevation and azimuth angles of a theodolite while visually tracking a pilot balloon.

The ascension rate of the balloon is approximately determined by careful inflation to a given total lift. After release from the ground, periodic readings (usually at one-minute intervals) of elevation and azimuth angles of the balloon are recorded. These data are transferred to a winds-aloft plotting board, and the wind speed and direction at selected levels are calculated by trigonometric methods.

PREVAILING WIND DIRECTION (or prevailing wind)

The wind direction most frequently observed during a given period. The periods most frequently used are the observational day, month, season and year.

PSD - Prevention of Significant Deterioration

A planning and management process under Sections 160 through 169 of the CAA for allocation and use of air resources.

RADIATION INVERSION

A type of atmospheric inversion occurring usually at night when the earth's surface loses heat by radiation, thus cooling the layer of air next to the ground. See INVERSION.

RESIDUAL FUEL OIL

The remainder after the more valuable petroleum gas, gasoline, lubricants, paraffin waxes and asphalt are removed from petroleum. This heavy oil is used as fuel and is graded number 4, 5, or 6, with the heavier grades bearing higher numbers. These grades are also cheaper and usually contain more sulfur. The amount of sulfur in the "RESID" depends on the feed stock (source of the crude oil) and the use of dehydrosulfurization processes.

RINGLEMANN CHART

A chart showing four numbered shades of gray as well as pure white and all black, used by visual comparison for estimating the density of smoke as it emerges from a stack. The matched comparison with the chart is referred to as a Ringlemann number.

SCATTERING COEFFICIENT

Amount of back scatter of light due to suspended particulate matter in the air and relates the measurement to visibility and the level of particulates.

SCRUBBER

Any device in which an aerosol is removed from a gas stream by a liquid droplet.

SETTLING CHAMBER

A simple particulate control device which consists of a large expansion in a flue or duct which results in a reduced pollutant velocity and subsequent particulate settling. The settled particulate is then mechanically removed from the chamber.

SETTLING VELOCITY

The speed at which an object will move through its surroundings under the force of gravity.

SIP - State Implementation Plan

A state developed, federally approved plan for implementing and enforcing requirements of the CAA.

SMOG

A combination of smoke and fog, usually generated as a result of atmospheric contamination. London (England) type smog arises as a result of the combined presence of sulfur oxides and particulates in a humid environment. Los Angeles smog or photochemical smog occurs when sunlight generated reactions involving hydrocarbon, ozone and nitrogen oxide take place. The smog is most visible when high concentrations of water vapor occur in the atmosphere simultaneously but may appear as a bluish haze in a dry atmosphere.

SOLAR RADIATION

The total electromagnetic radiation emitted by the sun.

SOOT

Aggregated particles of unburned carbon produced by incomplete combustion. The soot may contain sufficient amounts of sulfur oxides or compounds to damage paint or enamel finishes.

SPRAY CHAMBER

The simplest type of gas scrubber. Gas is passed countercurrent to falling drops of liquid (usually water) from a bank of spray nozzles. A typical appliction is the removal of fly ash and cinders from flue gases.

STABLE

Pertaining to the atmosphere or an atmospheric layer in the condition of static stability, that is, an atmosphere whose temperature lapse rate and moisture distribution is such as to suppress vertical exchange of air.

STAGNATION

With respect to air pollution, the persistence of a given volume of stable air over a region, permitting an abnormal buildup of pollutants from sources within the region.

STATIC STABILITY (Also called hydrostatic stability, vertical stability, convective or convectional stability).

The state of the atmosphere when it is stable relative to vertical displacements. Such an atmosphere tends to remain stratified, in that any air that is displaced vertically is subjected to a buoyant force that tends to restore it to its original level.

Static stability is determined primarily by the temperature lapse rate; an inversion layer is an extreme example of a statically stable layer.

STOICHIOMETRIC

In the exact combining proportions of materials involved in a specific chemical reaction.

SUBSIDENCE INVERSION

An atmospheric inversion due to the downward motion or air, about a stationary high-pressure area with concomitant adiabatic temperature rise. Such an inversion is common to Southern California in the warm months of the year. See INVERSION.

SURFACE INVERSION (or ground inversion)

A temperature inversion based at the earth's surface; that is, an increase of temperature with height beginning at the ground level.

This condition is due primarily to greater loss of heat due to radiation at and near the surface than at levels above. Thus, surface inversions are common over land prior to sunrise and in winter over high-latitude continental interiors.

SYNERGISM

Cooperative action of discrete pollutants such that the total effect is greater than the sum of the two effects taken independently.

TEMPERATURE INVERSION

A layer in which temperature increases with altitude. The principal characteristic of an inversion layer is its marked static stability, so that very little turbulent exchange can occur within it. Strong wind shears often occur across inversion layers, and abrupt changes in concentrations of atmospheric particulates and atmospheric water vapor may be encountered on ascending through the inversion.

When, in meteorological literature and discussion an "inversion" is mentioned, a temperature inversion is usually meant.

THEODOLITE

An optical instrument which consists of a sighting telescope mounted so that it is free to rotate around horizontal and vertical axis and graduated scales so that the angles or rotation may be measured. The telescope is usually fitted with a right-angle prism so that the observer continues to look horizontally into the eyepiece, whatever the variation of the elevation angle. In meteorology, the theodolite is used principally to observe the motion of a pilot balloon.

TOTAL LIFT

The upward force produced by the gas in a balloon. It is equal to the sum of the free lift, the weight of the balloon, and the weight of auxiliary equipment carried by the balloon.

WET COLLECTORS

Dust collectors which operate by contacting the dust with a liquid (usually water). The class includes spray chambers and atomizing scrubbers.

WIND

Air in motion relative to the surface of the earth. Since vertical omponents of atmospheric motion are relatively small, especially near the surface of the earth, meteorologists use the term to denote almost exclusively the horizontal component. Vertical winds are always identified as such.

WIND ROSE

A diagram showing the wind direction and speed and their variations for a day, a month, or any other specified period of time, for a specific location and altitude.

WIND VANE

An instrument used to indicate wind direction.

APPENDIX B

Ambient Air Quality Standards

APPENDIX B

AMBIENT AIR QUALITY STANDARDS

In December 1977, the Montana Board of Health and Environmental Sciences directed the Air Quality Bureau to propose an administrative rule containing new enforceable ambient air quality standards.

A set of standards had been on the books for ten years; however, they were considered as goals or guidelines rather than enforceable standards.

It was decided that before new standards were adopted there should be a thorough review to determine whether the old standards were still appropriate or whether scientific research completed since their adoption indicated different standards were necessary.

Subsequently, $147,000 was provided to hire a staff and consultants. This study was called the Montana Ambient Air Quality Standards Study (MAAQS).

As a result of this work a draft environmental impact statement was published in January 1979; a final statement in February 1980.

After several public hearings and testimony from numerous "experts", the Board of Health and Environmental Sciences adopted a set of "enforceable" standards in August 1980. Table AP-B-I lists the Montana and national ambient air quality standards. Additional information about the standards is provided on the following page.

TABLE AP-B-I

MONTANA AND NATIONAL AIR QUALITY STANDARDS

POLLUTANT	MONTANA STANDARD	FEDERAL PRIMARY STANDARD	FEDERAL SECONDARY STANDARD
Particulate Matter 10 microns (PM-10)+	50 $\mu g/m^3$ expected annual average 150 $\mu g/m^3$ expected 24-hr average*	50 $\mu g/m^3$ expected annual average 150 $\mu g/m^3$ expected 24-hour average*	Same as primary standard Same as primary standard
Sulfur Dioxide	0.02 ppm annual average 0.10 ppm 24-hr average* 0.50 ppm 1-hr average**	0.03 ppm annual average 0.14 ppm 24-hr average*	0.5 ppm 3-hr average*
Carbon Monoxide	9 ppm 8-hr average* 23 ppm hourly average*	9 ppm 8-hr average* 35 ppm 1-hr average*	9 ppm 8-hr average*
Nitrogen Dioxide	0.05 ppm annual average 0.30 ppm hourly average*	0.05 ppm annual average	0.05 ppm annual average
Photochemical Oxidants (ozone)	0.10 hourly average*	0.12 ppm 1-hour average*	0.12 ppm 1-hr average*
Lead	1.5 $\mu g/m^3$ 90-day average	1.5 $\mu g/m^3$ calendar qtr. avg.	None
Foliar Fluoride	35 $\mu g/g$ grazing season avg. 50 $\mu g/g$ monthly average	None	None
Hydrogen Sulfide	0.05 ppm hourly average*	None	None
Settled Particulate (Dustfall)	10 gm/m^2 30-day average	None	None
Visibility	Particle scattering coefficient of 3×10^5 per meter annual average***	None	None

PM-10 = particulate matter with an aerodynamic diameter less than 10 microns.
$\mu g/m^3$ = micrograms pollutant per cubic meter of sampled air.
ppm = parts pollutant per million parts of sampled air.
+Statistical standards based on three years of data.
*Not to be exceeded more than once per year.
**Not to be exceeded more than 18 times per year.
***Applies to PSD mandatory Class I areas.

Air quality standards have been developed at the national level for six classes of air pollutants and at the state level for nine pollutants plus visibility. Below is a synopsis of each of the pollutants.

Sulfur Dioxide - Sulfur dioxide originates from the burning of fossil fuels such as coal or oil and the smelting of metals ores. The pollutant is known for causing significant loss in crop yield, rusting metals, reducing visibility, and causing irritation of eyes, nose, throat, and lungs.

Particulate Matter - Particulate matter may originate from natural sources such as forest fires and erosion, or result from automobiles, industrial processes, unpaved roads, agriculture, construction, and other human activities. These tiny particles can damage paint, reduce visibility, and carry poisonous chemicals into the lungs causing cellular damage. PM-10 is particulate matter with an aerodynamic diameter of 10 microns or less. It is considered the respirable portion of particulate matter which is most likely to contribute to adverse health effects.

The PM-10 standards are based upon statistical methods which predict values in terms of expected annual averages, expected 24-hour averages, and expected number of exceedances. The expected exceedances are based upon averaging increasing years of data in an attempt to simulate long-term trends in emissions or meteorological conditions.

Carbon Monoxide - Carbon monoxide is a by-product of the incomplete combustion of organic fuels. The most notorious source is the automobile. This odorless gas can, in small amounts, cause headaches, dizziness, fatigue, and slow reactions. It can be especially dangerous for people with heart disease. In larger amounts it can cause death.

Photochemical Oxidants (Ozone) - Photochemical oxidants are produced in the atmosphere when hydrocarbons and nitrogen oxides, combustion wastes from gasoline and other fuels, are exposed to sunlight. Oxidants irritate the eyes, nose, and throat, make breathing difficult, reduce visibility, and damage vegetation.

Hydrocarbons - Hydrocarbons are the unburned chemicals from the combustion or evaporation of organic compounds. Automobile exhaust and uncontained storage of petroleum products are common sources of hydrocarbons. They have been known to cause vegetative damage and contribute to photochemical oxidants.

Nitrogen Oxides - Nitrogen oxides usually originate in high-temperature combustion processes including diesel engines. It is not only a component of photochemical oxidants, but causes an unpleasant smelling brown haze, and is irritating to the nose and throat.

Fluoride - Sources of fluorides include the aluminum, glass, brick, fertilizer and, to a small degree, the oil industries. In excessive amounts, fluorides can cause bone deformities and damage vegetation.

Lead - Lead in the air is generally the result of automobiles and ore smelters. Physical problems of high lead content include gastrointestinal cramps, central nervous system effects, kidney disease, and anemia.

Hydrogen Sulfide - Sources of hydrogen sulfide, the "rotten egg" pollutant include sewage treatment, kraft pulp, and oil industries. The pollutant can damage paint, tarnish copper, injure vegetation, produce a loss of the sense of smell, cause severe respiratory tract irritation, and in large doses, cause death.

Visibility - Visibility reductions are due to the amounts of TSP, aerosols, and gases present in the atmosphere.

APPENDIX C

Point Source Emission Estimates

APPENDIX C

POINT SOURCE EMISSION ESTIMATES

The following tables list emission estimates from various industrial sources in the state. Table AP-C-I lists sulfur dioxide emissions for 1988; Table AP-C-II lists particulates for 1988. The next two tables list point source emission estimates for these two pollutants for 1989.

TABLE AP-C-I

POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES - 1988

AQCR	Source	SO_2 Tons/Yr	County
140	East Decker Coal	21	Big Horn
	Westmoreland Resources	22	Big Horn
	Spring Creek Coal	9	Big Horn
	West Decker Coal	23	Big Horn
	Western Sugar	249	Yellowstone
	Continental Oil Co. (CONOCO)	2849	Yellowstone
	*Farmers' Union CENEX	5121	Yellowstone
	Exxon Co., USA	12096	Yellowstone
	Montana Sulfur	4162	Yellowstone
	Montana Power Co./Corette	7047	Yellowstone
141	Montana Refining Co.	2223	Cascade
	United Materials	1	Cascade
	Malmstrom AFB	4	Cascade
	Unocal	225	Glacier
	Gypsy Highview	164	Teton
	Northern Montana Gas	114	Toole
142	Stoltze Land & Lumber/Dillon	1	Beaverhead
	Continental Lime	397	Broadwater
	Pioneer Ready Mix	6	Gallatin
	Plum Creek/Belgrade	2	Gallatin
	Ideal Basic Industries	379	Gallatin
	Cyprus Mill/Three Forks	19	Gallatin
	Ash Grove Cement West	327	Jefferson
	Golden Sunlight Mine	4	Jefferson
	ASARCO, Inc.	27196	Lewis & Clark
	Helena Sand & Gravel	1	Lewis & Clark
	Park Co. Incinerator	15	Park
	Louisiana Pacific/Deer Lodge	2	Powell
	Stauffer Chemical/Ramsay	1389	Silver Bow
	Montana Resources	33	Silver Bow
143	Coastal Oil & Gas	945	Richland
	Holly Sugar	315	Richland
	Montana Dakota Utilities	1485	Richland
	Knife River Coal	1	Richland
	Western Gas Processors	44	Richland
	Peabody Coal	12	Rosebud

TABLE AP-C-I (cont.)

POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES - 1988

AQCR	Source	SO_2 Tons/Yr	County
143	MT Power Colstrip 1 & 2	4906	Rosebud
	Western Energy Coal	52	Rosebud
	Montana Power Colstrip 3	2507	Rosebud
	Montana Power Colstrip 4	2643	Rosebud
144	American Timber	1	Flathead
	Plum Creek/Evergreen	6	Flathead
	Plum Creek/Columbia Falls	15	Flathead
	Stoltze Land & Lumber/Col. Falls	4	Flathead
	Columbia Falls Aluminum	1805	Flathead
	Flathead County Asphalt	1	Flathead
	Plum Creek/Pablo	11	Lake
	Plum Creek/Fortine	2	Lincoln
	Champion/Libby	13	Lincoln
	W.R. Grace	27	Lincoln
	DAW Forest Products	2	Mineral
	Champion/Bonner	5	Missoula
	Louisiana Pacific Particleboard	3	Missoula
	Champion Intermountain	1	Missoula
	Pyramid Mountain Lumber	2	Missoula
	Stone Container	178	Missoula
	Western Materials	1	Missoula
	Missoula White Pine	1	Missoula
	Jensen Paving Co.	1	Missoula
	Stoltze-Conner Lumber	1	Ravalli
	Darby Lumber	2	Ravalli
	Thompson River Lumber	2	Sanders
	W.I. Forest Products	1	Sanders

* Due to varying inspection schedules, some sites were not inspected in 1988. The emissions for these plants reflect 1987 estimates.

TABLE AP-C-II

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1988

AQCR	Source	Part. Tons/Yr	County
140	East Decker Coal	590	Big Horn
	Westmoreland Resources	556	Big Horn
	Spring Creek Coal	596	Big Horn
	West Decker Coal	895	Big Horn
	Midland O'Leary	18	Yellowstone
	Cereal Foods Processors	220	Yellowstone
	Western Sugar	273	Yellowstone

TABLE AP-C-II (cont.)

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1988

AQCR	Source	Part. Tons/Yr	County
140	Empire Sand & Gravel	6	Yellowstone
	Continental Oil Co. (CONOCO)	173	Yellowstone
	*Farmers Union (CENEX)	429	Yellowstone
	Exxon Co. USA	870	Yellowstone
	Montana Power Co./Corette	788	Yellowstone
141	Interstate Specialties	43	Cascade
	General Mills	40	Cascade
	Montana Refining	10	Cascade
	Big Sky Feed & Supply	1	Cascade
	Great Falls City Asphalt Plant	1	Cascade
	United Materials	54	Cascade
	Conagra Feed	9	Cascade
	Cereal Food Processors	63	Cascade
	Department of Highways Asphalt	2	Cascade
	GTA Feeds	59	Cascade
	Malmstrom AFB	1	Cascade
142	Stoltze Land and Lumber/Dillon	137	Beaverhead
	Pfizer, Inc.	118	Beaverhead
	Continental Lime	360	Broadwater
	Pioneer Ready Mix	539	Gallatin
	Plum Creek/Belgrade	67	Gallatin
	Ideal Basic Industries	193	Gallatin
	Cyprus Ind. Minerals	118	Gallatin
	Kanta Products	14	Gallatin
	Montana Talc Mill/Sappington	25	Gallatin
	Ash Grove Cement West	1804	Jefferson
	Golden Sunlight Mine	1005	Jefferson
	ASARCO, Inc.	338	Lewis & Clark
	American Chemet	25	Lewis & Clark
	Helena Sand & Gravel	32	Lewis & Clark
	Cyprus - Yellowstone Mine	516	Madison
	Montana Talc Co. - Johnny Gulch	334	Madison
	Alcotech, Inc.	19	Meagher
	Brand S Lumber	104	Park
	Park County Incinerator	5	Park
	Park Lumber	11	Park
	Cominco	83	Powell
	Louisiana Pacific/Deer Lodge	66	Powell
	Stauffer Chemical/Ramsay	218	Silver Bow
	Riteway Asphalt	1	Silver Bow
	Butte-Silver Bow Asphalt	2	Silver Bow
	Gilman Excavating	1	Silver Bow
	Montana Resources	2850	Silver Bow
143	Century Paving/Glendive	84	Dawson
	Zortman Mining Co.	202	Phillips
	Landusky Mining Co.	452	Phillips
	Holly Sugar	105	Richland

TABLE AP-C-II (cont.)

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1988

AQCR	Source	Part. Tons/Yr	County
143	Montana-Dakota Utilities	123	Richland
	Knife River Coal	106	Richland
	Peabody Coal	581	Rosebud
	Montana Power/Colstrip 1 & 2	1429	Rosebud
	Western Energy	3046	Rosebud
	Montana Power/Colstrip 3	1281	Rosebud
	Montana Power/Colstrip 4	1410	Rosebud
144	American Timber	223	Flathead
	Plum Creek/Evergreen	443	Flathead
	Klingler Lumber	16	Flathead
	Plum Creek Lumber/Columbia Falls	471	Flathead
	Stoltze Land & Lumber/Col. Falls	302	Flathead
	Columbia Falls Aluminum	12	Flathead
	NUPAC	42	Flathead
	Flathead County Asphalt	39	Flathead
	B & J Lumber/Montana Mokko	12	Flathead
	Flathead Lumber	225	Lake
	Plum Creek/Pablo	227	Lake
	Owens and Hurst	47	Lincoln
	Plum Creek/Fortine	28	Lincoln
	ASARCO/Troy	84	Lincoln
	Champion/Libby	220	Lincoln
	W.R. Grace	2220	Lincoln
	DAW Forest Products	34	Mineral
	Northwestern Lumber & Cedar	13	Mineral
	Champion/Bonner	414	Missoula
	Louisiana Pacific Particleboard	183	Missoula
	Champion/Intermountain	76	Missoula
	Pyramid Mountain Lumber	60	Missoula
	Stone Container	739	Missoula
	Western Materials	19	Missoula
	Missoula White Pine	143	Missoula
	American Asphalt	10	Missoula
	City of Missoula Asphalt	1	Missoula
	Missoula county Asphalt Plant	2	Missoula
	Jensen Paving	80	Missoula
	Stoltze-Conner Lumber	108	Ravalli
	Darby Lumber	29	Ravalli
	Thompson River Lumber	140	Sanders
	W.I. Forest Products, Inc.	150	Sanders

* Due to varying inspection schedules, some sites were not inspected in 1988. The emissions for these plants reflect 1987 estimates.

TABLE AP-C-III

POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES - 1989

AQCR	Source	SO_2 Tons/Yr	County
140	*East Decker Coal	21	Big Horn
	Westmoreland Resources	25	Big Horn
	Spring Creek Coal	11	Big Horn
	*West Decker Coal	23	Big Horn
	Western Sugar	141	Yellowstone
	*Continental Oil Co. (CONOCO)	2849	Yellowstone
	*Farmers' Union CENEX	5121	Yellowstone
	*Exxon Co., USA	12096	Yellowstone
	Montana Sulfur	3634	Yellowstone
	Montana Power Co./Corette & Bird	7244	Yellowstone
141	Montana Refining Co.	2150	Cascade
	United Materials	1	Cascade
	Malmstrom AFB	7	Cascade
	Unocal	225	Glacier
	*Gypsy Highview	164	Teton
	Northern Montana Gas	132	Toole
142	Continental Lime	379	Broadwater
	Pioneer Ready Mix	6	Gallatin
	Plum Creek/Belgrade	4	Gallatin
	Ideal Basic Industries	379	Gallatin
	Ash Grove Cement West	327	Jefferson
	Golden Sunlight Mine	4	Jefferson
	*Montana Tunnels	48	Jefferson
	*ASARCO	27196	Lewis & Clark
	Helena Sand & Gravel	1	Lewis & Clark
	Park Co. Incinerator	16	Park
	*Mineral Hill Mine	1	Park
	*Louisiana Pacific/Deer Lodge	2	Powell
	*Rhone-Poulenc	1389	Silver Bow
	Montana Resources	40	Silver Bow
	Beal Mountain Pegasus	8	Silver Bow
143	Coastal Oil & Gas	691	Richland
	Holly Sugar	270	Richland
	Montana Dakota Utilities	969	Richland
	Knife River Coal	1	Richland
	Western Gas Processors	40	Richland
	Peabody Coal	43	Rosebud
	Montana Power/Colstrip 1	2356	Rosebud
	Montana Power/Colstrip 2	2992	Rosebud
	Western Energy Coal	44	Rosebud
	Montana Power/Colstrip 3	2097	Rosebud
	Montana Power/Colstrip 4	2302	Rosebud
	American Timber/Olney	1	Flathead
	Plum Creek/Evergreen	4	Flathead
	Plum Creek/Columbia Falls	10	Flathead
	Stoltze Land & Lumber/Col. Falls	2	Flathead

TABLE AP-C-III (cont.)

POINT SOURCE SULFUR DIOXIDE EMISSION ESTIMATES - 1989

AQCR	Source	SO_2 Tons/Yr	County
144	*Columbia Falls Aluminum	1805	Flathead
	NUPAC	1	Flathead
	*Flathead County Asphalt	1	Flathead
	*Plum Creek/Pablo	11	Lake
	Plum Creek/Fortine	2	Lincoln
	Champion/Libby	20	Lincoln
	W.R. Grace	10	Lincoln
	DAW Forest Products	2	Mineral
	Champion/Bonner	1	Missoula
	Louisiana Pacific Particleboard	3	Missoula
	Champion Intermountain	1	Missoula
	Pyramid Mountain Lumber	1	Missoula
	Stone Container	155	Missoula
	Western Materials	2	Missoula
	Missoula White Pine	2	Missoula
	Jensen Paving Co.	1	Missoula
	*Stoltze-Conner Lumber	1	Ravalli
	*Darby Lumber	2	Ravalli
	Thompson River Lumber	2	Sanders

* Due to varying inspection schedules, some sites were not inspected in 1989. The emissions for these plants reflect 1988 estimates.

TABLE AP-C-IV

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1989

AQCR	Source	Part. Tons/Yr	County
140	*East Decker Coal	590	Big Horn
	Westmoreland Resources	622	Big Horn
	Spring Creek Coal	737	Big Horn
	*West Decker Coal	895	Big Horn
	Midland-O'Leary	18	Yellowstone
	Cereal Food Processors	219	Yellowstone
	Western Sugar	145	Yellowstone
	Empire Sand & Gravel	6	Yellowstone
	*Continental Oil Co. (CONOCO)	173	Yellowstone
	*Farmers Union (CENEX)	429	Yellowstone
	*Exxon Co. USA	870	Yellowstone
	Montana Power Co./Corette & Bird	939	Yellowstone
141	Interstate Specialties	43	Cascade
	General Mills	40	Cascade
	Montana Refining	9	Cascade
	Big Sky Feed & Supply	1	Cascade

TABLE AP-C-IV (cont.)

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1989

AQCR	Source	Part. Tons/Yr	County
141	Harvest States Coop	1	Cascade
	Great Falls City Asphalt Plant	1	Cascade
	United Materials	61	Cascade
	Conagra Feed	9	Cascade
	Cereal Food Processors	63	Cascade
	Department of Highways Asphalt	1	Cascade
	GTA Feeds	59	Cascade
	Malmstrom AFB	2	Cascade
142	Stoltze Land & Lumber/Dillon	107	Beaverhead
	Pfizer, Inc.	120	Beaverhead
	Continental Lime	448	Broadwater
	Pioneer Ready Mix	517	Gallatin
	Plum Creek/Belgrade	505	Gallatin
	Ideal Basic Industries	217	Gallatin
	Cyprus Ind. Minerals	102	Gallatin
	Kanta Products	14	Gallatin
	Montana Talc Mill	39	Gallatin
	Ash Grove Cement West	1761	Jefferson
	Golden Sunlight Mine	1536	Jefferson
	Montana Tunnels/Pegasus	2268	Jefferson
	*ASARCO, Inc.	338	Lewis & Clark
	*American Chemet	25	Lewis & Clark
	Helena Sand & Gravel	35	Lewis & Clark
	Cyprus - Yellowstone Mine	607	Madison
	Montana Talc Co.	386	Madison
	Cyprus - M.P. Mine	32	Madison
	*Alcotech Inc.	19	Meagher
	Brand S Lumber	104	Park
	Park County Incinerator	5	Park
	Park Lumber	11	Park
	*Mineral Hill Mine	71	Park
	Cominco	73	Powell
	*Louisiana Pacific/Deer Lodge	66	Powell
	*Rhone-Poulenc/Ramsay	218	Silver Bow
	Riteway Asphalt Co.	4	Silver Bow
	*Butte-Silver Bow Asphalt	2	Silver Bow
	*Gilman Excavating	1	Silver Bow
	Montana Resources	3235	Silver Bow
	*Beal Mountain Mine	916	Silver Bow
	*Century Paving/Glendive	84	Dawson
	*Zortman Mining Co.	202	Phillips
	*Landusky Mining Co.	452	Phillips
	Holly Sugar	95	Richland
	Montana-Dakota Utilities	242	Richland
	Knife River Coal	131	Richland
	Peabody Coal	549	Rosebud
	Montana Power/Colstrip 1	465	Rosebud
	Montana Power/Colstrip 2	422	Rosebud

TABLE AP-C-IV (cont.)

POINT SOURCE PARTICULATE EMISSION ESTIMATES - 1989

AQCR	Source	Part. Tons/Yr	County
143	Western Energy	2483	Rosebud
	Montana Power Colstrip 3	1264	Rosebud
	Montana Power Colstrip 4	1357	Rosebud
144	American Timber/Olneg	219	Flathead
	Plum Creek/Evergreen	40	Flathead
	Klingler Lumber	19	Flathead
	Plum Creek Lumber/Columbia Falls	525	Flathead
	Stoltze Land & Lumber/Col. Falls	214	Flathead
	*Columbia Falls Aluminum	12	Flathead
	NUPAC	78	Flathead
	*Flathead County Asphalt	39	Flathead
	B & J Lumber	18	Flathead
	*Flathead Lumber	225	Lake
	*Plum Creek/Pablo	227	Lake
	Owens and Hurst	40	Lincoln
	Plum Creek/Fortine	24	Lincoln
	ASARCO/Troy	95	Lincoln
	Champion/Libby	558	Lincoln
	W.R. Grace	1588	Lincoln
	DAW Forest Products/Superior	33	Mineral
	Champion/Bonner	415	Missoula
	Louisiana Pacific Particleboard	192	Missoula
	Champion/Intermountain	76	Missoula
	Pyramid Mountain Lumber	66	Missoula
	Stone Container	533	Missoula
	Western Materials	20	Missoula
	Missoula White Pine	141	Missoula
	American Asphalt/Missoula Co.	14	Missoula
	City of Missoula Asphalt	1	Missoula
	Missoula County Asphalt Plant	3	Missoula
	Jensen Paving	86	Missoula
	*Stoltze-Conner Lumber	108	Ravalli
	*Darby Lumber	29	Ravalli
	Thompson River Lumber	136	Sanders
	W.I. Forest Products, Inc.	118	Sanders

* Due to varying inspection schedules, some sites were not inspected in 1989. The emissions for these plants reflect 1988 estimates.

APPENDIX D

Hi-Vol & PM-10 Sampling Schedules

APPENDIX D

SAMPLING SCHEDULES

High volume samplers (hi-vols) are usually operated on a one-in-six day schedule. In order to meet the needs of data collectors or hi-vol operators, hi-vol schedules for 1989 through 1991 are presented on the following pages.

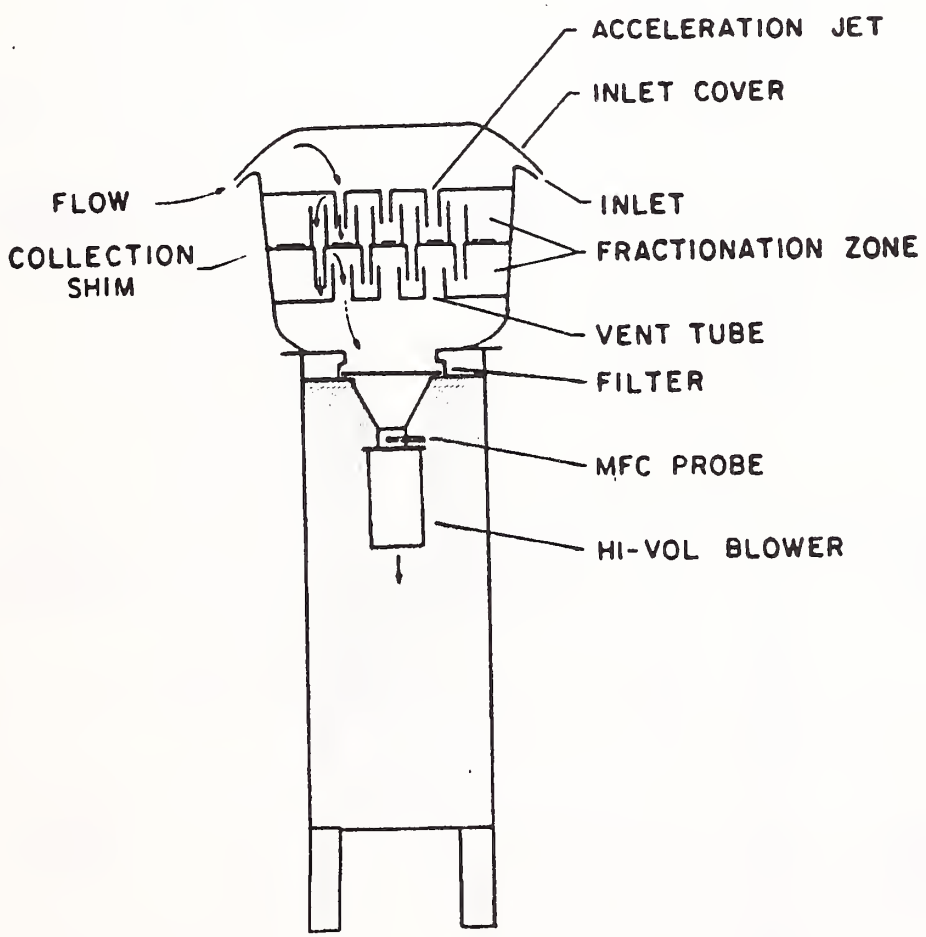


TABLE AP-D-I

1989 SAMPLING SCHEDULE

(Every Sixth Day)

QUARTER 1

January	February	March
4	3	5
10	9	11
16	15	17
22	21	23
28	27	29

QUARTER 2

April	May	June
4	4	3
10	10	9
16	16	15
22	22	21
28	28	27

QUARTER 3

July	August	September
3	2	1
9	8	7
15	14	13
21	20	19
27	26	25

QUARTER 4

October	November	December
1	6	6
7	12	12
13	18	18
19	24	24
25	30	30
31		
January (1990) 5		
11		
17		
23		
29		

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

TABLE AP-D-II

1990 SAMPLING SCHEDULE
(Every Sixth Day)

QUARTER 1

January	February	March
5	4	6
11	10	12
17	16	18
23	22	24
29	28	30

QUARTER 2

April	May	June
5	5	4
11	11	10
17	17	16
23	23	22
29	29	28

QUARTER 3

July	August	September
4	3	2
10	9	8
16	15	14
22	21	20
28	27	26

QUARTER 4

October	November	December
2	1	1
8	7	7
14	13	13
20	19	19
26	25	25
	31	

January (1991)
6
12
18
24
30

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

TABLE AP-D-III

1991 SAMPLING SCHEDULE
(Every Sixth Day)

QUARTER 1

January	February	March
6	5	1
12	11	7
18	17	13
24	23	19
30		25
		31

QUARTER 2

April	May	June
6	6	5
12	12	11
18	18	17
24	24	23
30	30	29

QUARTER 3

July	August	September
5	4	3
11	10	9
17	16	15
23	22	21
29	28	27

QUARTER 4

October	November	December
3	2	2
9	8	8
15	14	14
21	20	20
27	26	26
January (1992) 1		
7		
13		
19		
25		
31		

NOTE: The sampler should start at midnight, run for 24 hours on the date shown, and be stopped at midnight.

PM-10 SAMPLING SCHEDULE

PM-10 sampling schedules are determined according to an area's likelihood of exceeding the PM-10 standards. Every day monitoring is denoted as 1/1; one-in-three day sampling as 1/3; and one-in-six day sampling as 1/6. Schedules may vary from quarter to quarter. The PM-10 sites and their sampling schedules for 1988 and 1989 are listed below.

TABLE AP-D-IV
1988 PM-10 SAMPLING SCHEDULE

Region	SAROAD/AIRS Site Codes	Location	QUARTER 1	2	3	4
AQCR 141	0660 009 G01 013 0009 1	Fire Station, Great Falls			1/6	1/6
	0660 017 G01 013 0017 1	Downtown, Great Falls		1/6	down	down
AQCR 142	0120 002 F01 031 0002 1	East Main, Bozeman	1/6	1/6	1/6	1/6
	0160 005 F01 093 0005 2	Greeley School, Butte	1/1	1/1	1/1	1/1
	0720 001 F01 049 0001 2	Cogswell Bldg, Helena	1/2	1/2	1/2	1/2
	0720 001 F07 049 0001 4	Cogswell collocated, Helena	1/4	1/4	1/4	1/4
	0860 719 F02 049 0719 1	Hadfield, East Helena			1/3	1/2
AQCR 144	0270 003 F01 029 0003 2	Jr. High, Columbia Falls	1/2	1/1	1/1	1/1
	0800 015 F01 029 1015 2	Universal Athletics, Kalispell	1/1	1/1	1/1	1/1

Region	SAROAD/AIRS Site Codes	Location	QUARTER 1	2	3	4
AQCR 144	0820 013 K05 047 0013 1	Ronan Park, Ronan			1/1	1/1
	0820 028 K05 047 0028 2	Polson Saddle Shop, Polson			1/1	1/1
	0820 028 K07 047 0028 3	Saddle Shop collocated, Polson			1/4	1/4
	0900 012 F01 053 0012 2	Courthouse, Libby	1/1	1/1	1/1	1/1
	0900 012 F07 053 0012 4	Courthouse collocated, Libby	1/2	1/2	1/2	1/2
	0940 005 F01 053 1005 1	Lincoln Electric Coop., Eureka	1/2	1/2	1/2	1/2
	0940 007 F05 053 0007 1	Kendall Field, Libby	1/6	down	down	down
	1100 024 G01 063 0024 2	Boyd Park, Missoula	1/1	1/1	1/1	1/1
	1100 024 G07 063 0024 3	Boyd Park collocated, Missoula	1/3	1/3	1/3	1/3
	1100 031 G01 063 0031 2	Health Dept. Roof, Missoula	1/1	1/1	1/1	1/1
	1400 003 F01 089 0003 2	Sanders County Courthouse, Thompson Falls	1/2	1/2	1/1	1/1

TABLE AP-D-V

1989 PM-10 SAMPLING SCHEDULE

Region	SAROAD/AIRS Site Codes	Location	QUARTER 1	2	3	4
AQCR 140	0080 077 G02 111 0077 1	Federal Credit Union, Billings				1/6
	0080 077 G07 111 0077 2	Federal Credit Union				1/6
AQCR 141	0660 009 G01 013 0009 1	Fire Station, Great Falls	1/6	1/6	1/6	1/6
	0660 009 G07 013 0009 2	Fire Station, collocated	1/6	1/6	1/6	1/6
	0660 017 G01 013 0017 1	Downtown, Great Falls	1/6	1/6	1/6	1/6
AQCR 142	0120 002 F01 031 0002 2	East Main, Bozeman	1/6	1/6	1/6	1/6
	0160 005 F01 093 0005 2	Greeley School, Butte	1/1	1/1	1/1	1/1
	0720 001 F01 049 0001 2	Cogswell Building, Helena	1/2	1/2	1/2	1/2
	0720 001 F01 049 0001 4	Cogswell Building, collocated	1/4	1/4	1/4	1/4
	0860 719 F02 049 0719 1	Hadfield, East Helena	1/2	1/2	1/2	1/2
AQCR 144	0270 003 F01 029 0003 2	Jr. High, Columbia Falls	1/1	1/1	1/1	1/1
	0800 015 F01 029 1015 2	Universal Athletic, Kalispell	1/1	1/1	1/1	1/1
	0820 013 K05 049 0013 1	Ronan Park, Ronan	1/1	1/1	1/1	1/1

Region	SAROAD/AIRS Site Codes	Location	QUARTER 1	2	3	4
AQCR 144	0820 028 K05 047 0028 2	Polson Saddle Shop, Polson	1/1	1/1	1/1	1/1
	0820 028 K07 047 0028 3	Saddle Shop collocated, Polson	1/4	1/4	1/4	1/4
	0900 012 F01 053 0012 2	Courthouse, Libby	1/1	1/1	1/1	1/1
	0900 012 F07 053 0012 4	Courthouse collocated, Libby	1/2	1/2	1/2	1/2
	0940 005 F01 053 1005 1	Lincoln Electric Coop., Eureka	1/2	1/2	1/2	1/2
	1100 024 G01 063 0024 2	Boyd Park, Missoula	1/1	1/1	1/1	1/1
AQCR 144	1100 024 G07 063 0024 3	Boyd Park collocated, Missoula	1/3	1/3	1/3	1/3
	1100 031 G01 063 0031 2	Health Dept. Roof, Missoula	1/1	1/1	1/1	1/1
	1400 003 F01 089 0003 2	Sanders County Courthouse, Thompson Falls	1/1	1/1	1/1	1/1

APPENDIX E

Air Quality Personnel

APPENDIX E

AIR QUALITY PERSONNEL
1990

Air Quality Bureau

(406) 444-3454
(406) 657-2617 (Billings)

Jeffrey T. Chaffee, Chief
John Coefield
Ella Coenenberg (Billings)
Patricia Davidson
Pat Driscoll
Jan Gilman
David Haire
Charles Homer
Jim Hughes (Billings)
Bob Jeffrey
Kay Johnson
Harry Keltz
Warren Norton
Carolyn K. Pelletier
Jim Pickett
Jerry Preszler
Shirley Quick
Bob Raisch
Jerry Schneider
Stan Sternberg

Cascade County Air Pollution Control

(406) 761-1190

William Neilsen
Bruce Treis

Lewis and Clark County

(406) 443-1010

Will Selser
Larry Fenster
Howard Reid

Missoula City-County Health Department

(406) 523-4755

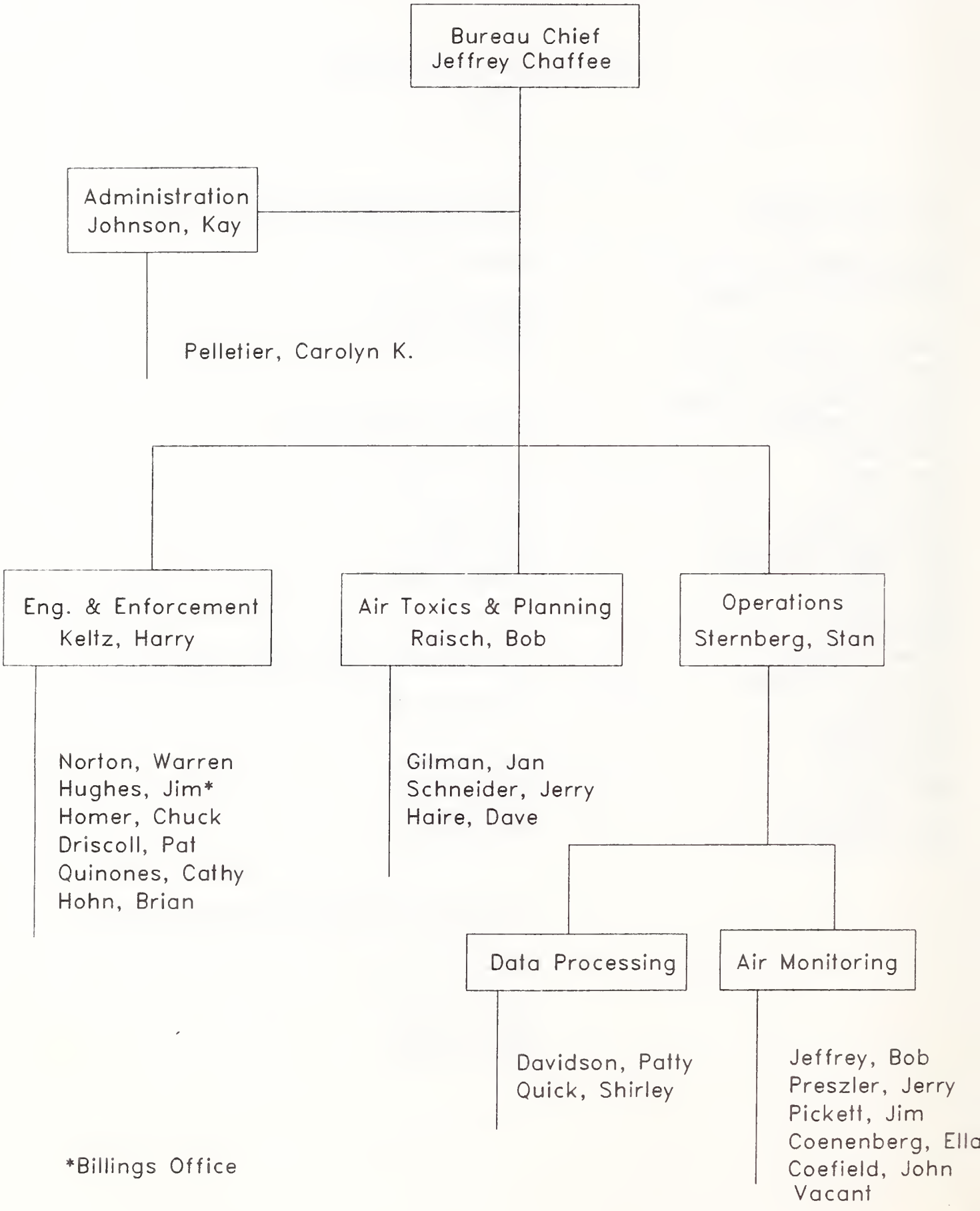
Jim Carlson
Scott Church
Bob Martin
Anne Agner

Yellowstone County Air Pollution Control

(406) 256-6841

Steve Duganz
Russ Boschee

AIR QUALITY BUREAU



*Billings Office

AIR QUALITY BUREAU

Section Responsibilities
1990

Administration Section

A. Budgeting
B. Planning
C. Office Management

Engineering and Enforcement Section

A. Permit Review
B. Inspections
C. Enforcement
D. Smoke Management
E. Open Burning Control
F. Emission Inventory
G. Asbestos Contractor Tracking
H. Complaint Investigations

Operations Section

A. Air Monitoring
B. Equipment Repair/Calibration
C. Quality Assurance
D. Dispersion Modeling
E. Data Processing/Computer Services
F. Annual Report and Network Review

Air Toxics and Planning Section

A. Air Toxics Program Development
B. State Implementation Plans (SO_2, PM-10, Lead and CO)
C. Wood Stoves
D. Non-attainment Studies

APPENDIX F

Attainment Nonattainment Designations

APPENDIX F

ATTAINMENT-NONATTAINMENT DESIGNATIONS

INTRODUCTION

The 1977 Clean Air Act Amendments, enacted by Congress August 7, 1977, contained many new and expanded requirements regarding the control of air pollution. One of the most significant requirements was to classify areas of the state according to whether they met the National Ambient Air Quality Standards (NAAQS). The department classified each area of the state into one of three categories: attainment - meeting the standards, nonattainment - exceeding the standards, or unclassified - insufficient information to determine the status. The areas which were designated nonattainment were required to develop revised State Implementation Plans to control emissions and bring the areas into compliance.

Since 1977, NAAQS have been promulgated by EPA for two additional pollutants: lead and PM-10. A somewhat different classification scheme was used for these pollutants to identify those areas of Montana which were exceeding or likely to exceed the standards.

Classification Requirements: Carbon Monoxide, Nitrogen Dioxide, Ozone, Sulfur Dioxide, and Total Suspended Particulate

Five classifications were possible - three for particulate matter (PM) and sulfur dioxide (SO_2) and two for pollutants other than particulate matter or sulfur dioxide. The five classifications are summarized below.

A) Do not meet a national primary ambient air quality standard for oxidants, carbon monoxide (CO) or nitrogen dioxide (NO_2).

B) Do not meet, or in the judgment of the State will not attain or maintain in the time required by the applicable SIP, any national primary ambient air quality standard for sulfur dioxide or particulate matter.

C) Do not meet a national secondary ambient air quality standard.

D) Cannot be classified as B or C, on the basis of available information, for PM or SO_2.

E) Have ambient air quality levels better than any national primary or secondary ambient air quality standard for oxidants, CO or NO_2, or for which there is insufficient data to be classified A or C.

Areas designated as A, B, or C were referred to as nonattainment areas, and areas designated as D or E were referred to as attainment (or unclassified) areas.

Classification Requirements: Lead

Three classifications were possible for lead:

A) Areas attaining the ambient air quality standards for lead.

B) Areas in the vicinity of certain specified types of point sources including primary lead smelters or in the vicinity of any other stationary source which emits 25 tons or more of lead.

C) Any other area that has lead concentrations in excess of the ambient air quality standard.

Areas designated as A were considered to be in compliance with the lead standard while areas designated as C were considered to be out of compliance. Areas listed under B required additional study to eventually determine whether they were in or out of compliance.

Classification Requirements: PM-10

Three classifications were possible for PM-10

A) Group I - greater than a 95% probability of exceeding the standards.

B) Group II - 20-95% probability of exceeding the standards.

C) Group III - less than 20% probability of exceeding the standards.

Areas designated as Group I were considered to be out of compliance with the standard while Group III areas were considered to be in compliance. Areas listed as Group II required additional study to eventually determine their compliance status.

Air Quality Data

For CO, NO_2, O_3, SO_2 and TSP, the department used, whenever possible, the last four consecutive quarters of air quality data to propose the designations. Data was available from two ozone sites, two nitrogen oxides sites, three carbon monoxide sites, eleven sulfur dioxide sites, and fifty total suspended particulate sites. For lead and PM-10, the department used the three most current years of data available just prior to the promulgation of the standards.

Designation Proposal

On January 6, 1978, the department submitted to EPA a proposed attainment/nonattainment designation document for CO, NO_2, O_3, SO_2 and TSP. The table which follows is a summary of that document. It should be noted that rural areas

(less than 50,000 pop.) with high total suspended particulate concentrations were not designated nonattainment if the primary cause of the violations was uncontaminated (non-industrial) fugitive dust. Classification of lead and PM-10 areas was completed later after the promulgation of the standards. The designation status for these pollutants is also discussed in the following table.

TABLE AP-F-I

INITIAL ATTAINMENT STATUS

1. Oxidants

The department proposed that the entire state be unclassified for oxidants.

2. Nitrogen Oxides

	Designation		
Designated Area	107(d)(1)(A) Nonattainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings, MT area			*
Colstrip, MT			*
Butte, MT		*	
Rest of State		*	

3. Carbon Monoxide

	Designation		
Designated Area	107(d)(1)(A) Nonattainment	107(d)(1)(E) Unclassified	107(d)(1)(E) Attainment
Billings Downtown Area	*		
Butte Area		*	
Colstrip Area		*	
Great Falls		*	
Missoula Area	*		

TABLE AP-F-I (cont.)

INITIAL ATTAINMENT STATUS

4. Sulfur Dioxide

	Designation		
	Nonattainment		
Designated Area	107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Anaconda Area	*		
Laurel Area	*		
East Helena Area	*		
Billings			*
Colstrip Area			*
Rest of State			*

5. Total Suspended Particulate

	Designation		
	Nonattainment		
Designated Area	107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
Decker			*
Hardin			*
Billings Downtown		*	
Billings Area			*(1)
Great Falls CBD		*	
Great Falls Area			*(2)
Butte Area		*	
Philipsburg			*(1)

TABLE AP-F-I (cont.)

INITIAL ATTAINMENT STATUS

Designated Area	Designation Nonattainment 107(d)(1)(B) Primary	107(d)(1)(C) Secondary	107(d)(1)(D) Not B or C
East Helena		*	
Three Forks			*(1)(2)
Miles City			*
Ekalaka			*(2)
Fort Peck			*
Lame Deer			*
Scobey			*
Glendive			*
Colstrip	*		
Broadus			*(1)
Lindsay			*(1)
Poplar			*
Columbia Falls	*		
Kalispell			*(1)
Libby			*
Troy			*
Missoula Area	*	*	

(1) Violation of standard due to fugitive dust from non-industrial sources - unpaved roads, etc.
(2) Insufficient data from which to classify the area.

TABLE AP-F-I (cont.)

INITIAL ATTAINMENT STATUS

6. Lead

Designated Area	Designation: Out of Compliance	Designation: In Compliance
East Helena Area	*	
Rest of State		*

7. PM-10

Designated Area	Designation: Group I	Designation: Group II	Designation: Group III
Libby	*		
Kalispell	*		
Ronan	*		
Polson	*		
Lame Deer	*		
Missoula	*		
Butte	*		
Hays		*	
Columbia Falls		*	
Anaconda		*	
Helena & East Helena		*	
Thompson Falls		*	
Eureka		*	
Rest of State			*

Revisions/Considerations of the Original Designation Proposal

Soon after the department submitted its original proposal in 1978, new data indicated other areas were violating standards. In the years that followed, standards for lead and PM-10 were adopted and changes to the original proposal have developed. The following discusses some of the revisions and considerations of the original designation proposal.

Statewide - TSP/PM-10

On July 31, 1987, the Environmental Protection Agency (EPA) promulgated new ambient air quality standards for particulate matter. The new standards changed the focus from larger particles (total suspended particulates - TSP) to smaller inhalable particles known as PM-10 (particles with an aerodynamic diameter less than 10 microns).

As control plans are developed and approved for the areas exceeding the PM-10 standards, the TSP designations for the areas will be eliminated.

After reviewing existing TSP and PM-10 data, the state and EPA have assigned various parts of Montana to one of three categories. Seven communities were identified as Group I areas (likely to violate the standards), six as Group II areas (may violate the standards) and the rest of the state was considered in attainment. Table AP-F-II below identifies the SIP requirements for each group.

TABLE AP-F-II

PM-10 SIP REQUIREMENTS

Grouping	SIP Requirements
I	1. Daily PM-10 monitoring 2. Develop control plan by May 1, 1988 3. Implement control plan within 3 years after EPA approval
II	1. Every other day monitoring 2. Commit to determining the compliance status of the area
III	1. Every sixth day monitoring when resources are available

On April 25, 1988, Montana submitted a committal SIP to EPA that (a) adopted state PM-10 standards identical to the federal standards, (b) repealed the TSP standards, (c) adopted several statewide PM-10 control strategies, (d) incorporated PM-10 into our emergency episode plan, (e) committed to perform the SIP requirements listed in Table

AP-F-II, (f) incorporated PM-10 into Montana's new source review and prevention of significant deterioration programs, and (g) requested that EPA redesignate Colstrip, Billings and Great Falls to unclassified for TSP. To date, EPA has not acted on the submittal.

1. Anaconda - SO_2

The Anaconda area was designated nonattainment for sulfur dioxide. The area experienced frequent violations of the ambient air quality standards for sulfur dioxide as a results of the Anaconda Company (ARCO) copper smelter complex. In July, 1980, the smelter temporarily ceased operations as a results of a strike. In September of the same year, Anaconda announced it was permanently ceasing operations at the smelter. As a result of these conditions, the state requested the area be redesignated to attainment. The designation to attainment was made final on July 15, 1982 (47 FR 30762).

2. Billings - TSP

Billings was designated as nonattainment for total suspended particulates. The TSP plan was approved on March 4, 1980 (45 FR 14036). The secondary standard for TSP is nearing attainment as a result of extensive street sweeping and flushing programs. With the promulgation of the PM-10 standards, the department and EPA predict that Billings will be in compliance with particulate standards. Therefore, on April 25, 1988, the department requested that the Billings area be redesignated to unclassified for TSP. As yet, EPA has not responded to the department's request.

3. Billings - CO

Montana initially proposed that only the downtown area of Billings be designated nonattainment for carbon monoxide. However, on March 3, 1978, (43 FR 8964) EPA designated the entire city of Billings as nonattainment for carbon monoxide. The plan for attainment of the 8-hour CO standard predicted that a modification of the Exposition Drive-First Avenue North intersection would achieve the standards. A proposal to approve the plan appeared on July 23, 1984 (49 FR 29620). Final approval was given on January 16, 1986, (51 FR 2397).

Data collected during the two years following the modification to Exposition Drive (1985-1986) indicated compliance with the standards. Unfortunately, the amount of data collected did not meet completeness requirements and EPA requested that the monitoring site be relocated to a position nearer the road. Therefore, Yellowstone County initiated CO monitoring during the fall of 1988 at a new EPA-approved location. During 1989, Yellowstone County completed a CO emission inventory and performed short-term monitoring in other parts of Billings. During 1990 and 1991, additional short-term monitoring will be conducted and, if the data indicates compliance, the department will submit a request to redesignate the area to attainment in 1991.

4. Butte - TSP/PM-10

Soon after the department submitted its proposal, additional data from Butte indicated the area was violating primary standards for total suspended particulates. As a result, EPA immediately promulgated a nonattainment designation for Butte for violation of the primary standard.

The original SIP called for attaining the standard through enforcement of the airborne particulate rule. The Department of Health and Environmental Sciences and Department of Highways were to develop a set of emission factors for paved and unpaved roads and apply these factors to the appropriate streets in the Butte area. As it turned out, the development of these factors proved impossible. The department turned its attention to developing a control plan in conjunction with the Anaconda Minerals Company (ARCO) and the city of Butte.

A plan which called for a permit from ARCO and street paving and sweeping by the City of Butte was developed and approved by the Board of Health. The plan was submitted to EPA in February 1983. EPA has made several inquiries into the plan regarding attainment of the short-term standard. The state has submitted information showing that the short-term standard was never exceeded in Butte through 1984. EPA indicated that they would only designate the area attainment for the primary standard since the modeling submitted did not show attainment of the secondary standard.

Subsequent to the department's 1983 submittal of a TSP control plan for Butte, particulate levels once again increased to the point where TSP and PM-10 primary standards are again being exceeded. In 1989, the department completed a source apportionment study in Butte which identified emissions from re-entrained road dust, wood stoves, and industry as the primary cause of noncompliance. Therefore, the department and Butte/Silver Bow are currently designing control strategies for these sources.

Concurrent with the department's efforts in regard to PM-10, EPA completed its review of the original 1983 TSP control plan. On January 26, 1989 (FR 54 3779), EPA approved the TSP control measures for Butte, but required Montana to incorporate wood stove control measures into the developing PM-10 control plan.

5. Colstrip - TSP

Colstrip was designated as nonattainment for TSP in 1978. The control strategy involved a permit for the nearby coal mines. Such a permit was evaluated and issued according to the plan.

EPA proposed to approve the plan on July 5, 1983, (48 FR 30696) and then again on July 23, 1984, (49 FR 29620). The plan was finally approved on April 26, 1985, (50 FR 16475).

Montana, in cooperation with Montana Power Company, Western Energy Company, and Peabody Coal Company, prepared a redesignation request. The request

was submitted to EPA and given final approval on April 26, 1985, (50 FR 16475). The change in status from nonattainment to attainment applies only to the primary standard. The area remains nonattainment for the secondary TSP standard.

With the promulgation of the PM-10 standards, the department and EPA predict that Colstrip will be in compliance with particulate standards. Therefore, on April 25, 1988, the department requested that the area be redesignated to unclassified for TSP. As of this date, EPA has not responded to the department's request.

6. Columbia Falls - TSP/PM-10

Columbia Falls was designated as nonattainment for total suspended particulates based upon the Anders monitoring site. The control strategy for this area involved the rebuilding of Highway 40 and Nucleus Avenue through Columbia Falls. The paving project for Nucleus was completed in late fall, 1982. Highway 40 was finished in fall, 1984. Data to date does not exhibit a clear pattern. The readings had been dropping as a result of the SIP, but other factors may now be influencing the site.

In August 1987, the department and EPA designated Columbia Falls as a Group II area for PM-10. In September 1987, every other day PM-10 monitoring was initiated. In October 1987, PM-10 monitoring showed violations of the new PM-10 standards. Consequently, the department will be conducting studies to identify the major emission sources. Once the sources are determined, a control plan will be developed and submitted to EPA. The department anticipates that the plan will be submitted to EPA by July 1991.

7. East Helena - TSP

East Helena was designated as a nonattainment area for total suspended particulates based upon the Hastie monitoring site. No special control strategy was implemented since the emission inventory demonstrated over 50% of the particulate emissions were from nearby highway construction. In addition, ASARCO agreed to reduce TSP emissions from slag piles by spraying the piles with water or other coating material. The data from Hastie for years 1981-85 indicate compliance with primary and secondary standards. The data for the Hadfield and Firehall sites, however, are slightly higher. These data indicate exceedances of the secondary standard in 1985 and 1986. With the promulgation of the PM-10 standards, the department and EPA predicted that East Helena has a good chance of being in compliance with particulate standards. If PM-10 monitoring verifies this prediction, the department will request that the area be redesignated to unclassified for TSP and in compliance for PM-10.

8. East Helena - SO_2

East Helena was designated nonattainment for sulfur dioxide in 1977. The ASARCO smelter installed an acid plant with several modified stacks to reduce the sulfur dioxide emissions. Data for the past six years shows no violations of national or Montana ambient air quality standards.

The department submitted a plan designed to achieve compliance on April 24, 1979. On November 20, 1980 (45 FR 76685), EPA conditionally approved the plan contingent upon the department's demonstrating that the stack represented "good engineering practice." The department submitted the demonstration report on October 18, 1982. Although the department, on October 24, 1983, requested that the area be redesignated to attainment for sulfur dioxide and EPA proposed to approve the plan (7/5/83, 48 FR 30696), final action was not taken due to litigation concerning the federal stack height regulations. As a result of the litigation, the federal stack height rule was revised on July 5, 1985 (50 FR 27892). Montana submitted a revised stack height rule to EPA on March 28, 1986. At this time, EPA has not taken final action on the department's stack height rule or the request for redesignation.

9. East Helena - Lead

EPA promulgated ambient air quality standards for lead on October 5, 1978. The East Helena area was determined to be in violation of the lead standards based on data from the Hastie site.

The department conducted extensive studies to determine the proper source apportionment. Based upon this data, a SIP was developed in cooperation with ASARCO, American Chemet, the City of East Helena, and the Montana Department of Highways. The plan was approved by the Board of Health and Environmental Sciences and submitted to EPA on September 29, 1983. EPA gave final approval to the plan on July 9, 1984 (49 FR 27944). The plan required ASARCO to control several fugitive dust sources including the ore storage piles and roads in and out of the facility. ASARCO also was to install an air control system on the #1 blast furnace and enclose the top of both blast furnaces and ventilate the exhaust to the baghouse. The Montana Highway Department was required to regularly sweep Highway 12 through East Helena.

As of December 31, 1986, all the control strategies in the plan were implemented. Unfortunately, ambient air monitoring data for 1987 through 1989 indicated that lead levels decreased but remained above the lead standard. As a result, EPA notified Montana on October 1, 1988, that the East Helena lead SIP was substantially inadequate. Therefore, Montana is revising the East Helena lead SIP and will submit the document to EPA by February 1992.

10. Great Falls - TSP

The Great Falls area was designated nonattainment of the secondary standard for total suspended particulates. The city has instituted a sweeping/flushing program to control particulate emissions. Data for 1983 indicate compliance with the secondary standard while 1982, 1984, and 1985 show exceedances of the secondary standard. With the promulgation of the PM-10 standards, the department and EPA predict that Great Falls will be in compliance with particulate standards. Therefore, on April 25, 1988, the department requested that the area be redesignated to unclassified for TSP. As of this date, EPA has not responded to the department's request.

11. Great Falls - CO

A corridor along Tenth Avenue South was designated as nonattainment for carbon monoxide in September 1980. The Great Falls City-County Planning Agency was designated as the lead agency to develop a SIP. The plan was developed in conjunction with the Highway Department and Air Quality Bureau. The plan shows that an improvement in automobile emissions as a result of EPA-mandated emission standards and reductions at the Montana Refining Company (formerly Phillips Petroleum Company) will bring the area into compliance by the end of 1985 or 1986. In addition to the improvements in automobiles, the city has completed a number of projects such as improved traffic synchronization, widening of the Warden Street bridge, and a new mass transit system which should assure attainment.

During the review process, it was discovered that emission reductions planned at the Montana Refining Company never occurred. The department discussed this matter with Montana Refining and a compromise solution was worked out. This reduced the base year emissions from 10,000 tons/year to approximately 4,700. The revised plan was approved by the board on March 7, 1986, and subsequently submitted to EPA on March 28, 1986. EPA proposed to approve the plan on January 26, 1987 (52 FR 2732). However, prior to final approval, ambient air monitoring data indicated continuing noncompliance at a monitoring site near 10th Avenue South. As a result, EPA notified Montana on June 17, 1988, that the Great Falls CO SIP was substantially inadequate. Therefore, the department and Cascade County have performed an emission inventory to assist in developing a revised SIP. Cascade County and the department believe that federal automobile tailpipe standards will be sufficient to achieve compliance.

12. Kalispell - PM-10

On August 7, 1987, Kalispell was designated as a Group I area for PM-10. The department completed a PM-10 emission inventory and a chemical mass balance study during 1989. These studies identified re-entrained road dust as the primary cause of noncompliance.

In January 1990, the Kalispell City Council adopted an ordinance and resolution designed to control re-entrained road dust by establishing specifications for sanding material and an improved street sweeping and flushing program. The control plan will be submitted to EPA by July 1, 1990.

13. Lame Deer - PM-10

On August 7, 1987, Lame Deer was designated as a Group I area for PM-10. During early 1990, the Northern Cheyenne Indian Tribe received from their contractor the results of a chemical mass balance study and an optical microscopy study. These studies identified re-entrained road dust as the primary cause of noncompliance.

The tribe is currently developing a silt loading standard for streets in Lame Deer. The regulation will require action (sweeping, sanding specifications, road reconstruction, etc.) by the appropriate road maintenance jurisdiction whenever the standard is exceeded.

The Northern Cheyenne Tribe expects to have a regulation in place and submit an implementation plan to EPA by July 1, 1990.

14. Laurel/Billings - SO_2

The Laurel area was designated as nonattainment for sulfur dioxide due to readings near the Cenex refinery. Modeling calculations showed potential violations within the Billings area as well. In 1977, a stipulation was signed between the various sulfur dioxide sources and the Department of Health and Environmental Sciences to further study the matter. The stipulation also required some modifications at these sources. An ambient sampling program, as required by the stipulation, was completed in October 1982. The results of the ambient air quality monitoring indicate compliance with the national standards except for one 3-hour episode in January 1985. The department has investigated this matter and traced the problem to a malfunction at the Conoco refinery.

The department and the Billings area industries restored SO_2 monitoring in the Billings/Laurel area in 1987. Based on the results of the monitoring, the area appears to be in compliance with national ambient air quality standards. If the data continues to show compliance, Montana will prepare a request for redesignation for submittal to EPA.

15. Libby - PM-10

On August 7, 1987, Libby was designated as a Group I area for PM-10. The department completed a PM-10 emission inventory and chemical mass balance study during early 1990. These studies identified re-entrained road dust and residential wood burning as the primary cause of noncompliance.

A set of draft regulations to control the above-mentioned sources have been prepared. The department expects to finalize the regulations and submit a SIP control plan by the end of 1990.

16. Missoula - TSP/PM-10

The city of Missoula has been designated as nonattainment for total suspended particulates. The city incorporated a systematic program of street sweeping and flushing to show attainment by 1982. Although not actually part of the plan, Missoula has implemented several control measures directed at emissions from residential wood stoves. The plan was approved by EPA in September 23, 1980 (45 FR 62984). EPA approved a minor revision to the plan (removing two street paving projects) on January 16, 1986. Data to date indicates compliance with the annual TSP standard, but an occasional excursion over the 24-hour standard still occurs.

Ambient air quality data also indicates that Missoula exceeds the new PM-10 standards. The Missoula County Health Department has developed a new PM-10 SIP

and Montana expects to submit the plan to EPA by July 1, 1990. The PM-10 SIP consists of an improved street sweeping program and a requirement to use clean, durable sanding material.

17. Missoula - CO

Missoula was designated as nonattainment for carbon monoxide based on a monitoring station near the intersection of Brooks, Russell, and South (Malfunction Junction). A plan was developed which called for the reconstruction of the intersection. This reconstruction was completed in late 1985. The plan was proposed for approval on July 23, 1984 (49 FR 29620) and received final approval on January 16, 1986, (51 FR 2397). EPA's approval notes that the potential exists that areawide sources such as wood stove emissions may be contributing to the problem and this needs to be watched closely in the future.

The Missoula County Health Department continues to monitor CO at two locations and the resulting data indicates ongoing violations of the CO standards. As a result, EPA notified Montana on June 17, 1988, that the Missoula CO SIP was substantially inadequate. Therefore, the department and Missoula County performed an emission inventory to assist in developing a revised SIP. Missoula County and the department intend to submit the revised SIP to EPA in late 1991.

18. Polson - PM-10

On August 7, 1987, Polson was designated as a Group I area for PM-10. During 1989, the Confederated Salish and Kootenai (CS&K) Tribes contracted with a consulting firm to perform a PM-10 emission inventory and chemical mass balance study. Although the studies identified re-entrained road dust as the main cause of noncompliance, EPA identified several technical deficiencies in the study. Therefore, the CS&K Tribes are in the process of contracting for additional source identification work.

19. Ronan - PM-10

On August 7, 1987, Ronan was designated as a Group I area for PM-10. During 1989, the CS&K Tribes contracted with a consulting firm to perform a PM-10 emission inventory and chemical mass balance study. Although the studies identified re-entrained road dust as the main cause of noncompliance, EPA identified several technical deficiencies in the study. Therefore, the CS&K Tribes are in the process of contracting for additional source identification work.

20. Thompson Falls - PM-10

On August 7, 1987, Thompson Falls was designated as a Group II area for PM-10. However, by early 1990, PM-10 monitoring indicated that Thompson Falls was in violation of the PM-10 standards.

As a result, the department is initiating studies to identify the emission sources which are causing noncompliance. Based on the results of the study, a control plan will be developed and submitted to EPA during 1992.

Impacts of Designation

Designation of an area as nonattainment, or noncompliance in the case of lead and PM-10, triggers the requirement to develop a control plan to bring the area into compliance. The final compliance date for primary sulfur dioxide and total suspended particulate standards was December 31, 1982. For carbon monoxide and oxidants, the act provided for extensions up to December 31, 1987. Obviously, these dates have passed and Montana still has areas exceeding the standards. Therefore, Montana must revise its control plans and Congress is currently struggling with the long-term noncompliance question.

Although Montana has areas which exceed the PM-10 and lead standards, these areas are not subject to the same requirements of other nonattainment areas. These areas are required to develop control strategies but have three years from the date EPA approves the control plan to comply.

The department developed control plans for each of the nonattainment areas and they are contained in the State Implementation Plan. Many of the plans were modified as more accurate air quality and emissions data became available. Some of the plans such as the East Helena sulfur dioxide plan were carried out with good success. Others were unnecessary due to plant shutdowns as was the case in Anaconda. The plans for carbon monoxide have been followed and are showing progress toward compliance. However, additional controls will be necessary in Missoula and Great Falls. Although plans were developed for particulates, progress has been slow due to expensive and untried control strategies and the need for frequent plan modifications. Nevertheless it appears that compliance with the primary total suspended particulate standard has been achieved in Colstrip and Columbia Falls. In addition, the promulgation of the PM-10 standards will likely remove the TSP nonattainment designation for secondary standards in Colstrip, Great Falls and Billings.

The department is continuing to work on the particulate problem; however, the newly promulgated PM-10 standard may change the appropriate control strategies. Since the PM-10 standard considers only particles less than 10 microns in diameter vs. 40 microns for total suspended particulate, control strategies will need to be directed at sources of fine particulate.

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